



Fachbereich Wirtschaftswissenschaft

**Sustainable Freight Village Concepts
for Agricultural Products Logistics**
– A Knowledge Management-oriented Study –

Dissertation

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ABSTRACT

Freight villages (FVs) are logistics phenomenon with broad economic, environmental, and social consequences. It has a major impact on the reduction of economic costs, and also on limiting negative externalities, e.g. traffic congestion, air pollution. On the other hand, consisting of a cluster of firms with intensive logistics-related operations especially transportation, any FV potentially pollutes the environment. Thus, a sustainable development way is required. This research extends sustainability in the context of FVs to twofold meanings. This includes the sustainable development of FVs, and the sustainability contributions they created.

China has showed a more recent but quicker story in developing FVs. FV projects are regarded as a country-level strategy there today. Nevertheless, a number of problems and limits exist. Taking China as research background, this research consists of theoretical explorations, status quo analysis, and practical applications in agricultural products logistics (APL).

Due to the lack of a systematic approach towards sustainable FV planning and operations, however, existing literature has yet to clearly define what strategic direction should be taken. This research proposes that a knowledge-based strategy, i.e. knowledge management (KM) is the most desirable option to reach sustainable values of FVs.

The status quo analysis examines the adaption of FVs to China's current logistics situation. It identifies several orientations for the next development step of FVs: sustainability considerations, adequate FV project definition and planning, knowledge-based approaches, and the prospects of integrating FVs in freight-related fields for sustainability consequences.

The planning stage of a FV project is a technical and political process characterized by knowledge-intensive activities. To cope with the pervasive problems during FV planning stage, this research adopts "sense-making KM" approach to guide a systematic planning process including sense making, knowledge creation, and decision making. This method is able to avoid unsustainable trajectories of FV development from the outset, e.g. high vacancy rate, unsuitable location choice, few positive contributions to the surrounding industries.

In order to achieve a high sustainability rating, this research uses KM cycle model to

generate synergies among major stakeholders of FVs. Moreover, it proposes a roadmap for organizing KM process so as to build sustainability capability. The roadmap is based on social foundation layer, functional layer, and auditing layer. Three key elements for the roadmap are identified: human ability, stakeholder engagement, and information system. Moreover, a checklist for building sustainability capability is provided according to the structure of sustainability balanced scorecard. Promisingly, it can inspire FV decision makers and operators to convert knowledge into sustainable performance.

This research focuses on the application of sustainable FV concepts for APL. It deals with issues affecting city logistics and agricultural products (agri-products) supply in China. This can make best use of FV functions from a sustainability perspective. Agri-FV is proposed to bring professional logistics facilities and services, efficient distribution of agri-products, and information-based operations. An integrated APL system is structured consisting of farmers' cooperatives, chain stores, and agri-FVs. In this system, agri-FV plays an important role in leveraging sustainability outcomes. Furthermore, KM approaches are applied to agri-FV project planning and operations, meanwhile considering the characteristics of agri-products and APL.

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LIST OF ABBREVIATIONS

3PLs	Third Party Logistics Providers
Agri-FV	Agricultural Freight Village
Agri-products	Agricultural Products
APL	Agricultural Products Logistics
BSC	Balanced Scorecard
CBOT	Chicago Board of Trade
CFLP	China Federation of Logistics and Purchasing
CNY	China Yuan
CSL	China Society of Logistics
CSR	Corporate Social Responsibility
DGG	Deutsche GVZ-Gesellschaft mbH
EDI	Electronic Data Interchange
EU	European Union
Europplatforms	European Association of FVs
FCT	Traffic Center Terminal
FV(s)	Freight Village(s)
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPS	Global Positioning System
GIS	Geographic Information System
GVZ	Güterverkehrszentren
IoT	Internet of Things
ISL	Institute of Shipping Economic and Logistics
ISO	International Organization for Standardization
KM	Knowledge Management
KSP	Knowledge Sharing Platform
LPI	Logistics Performance Index
MA-KSP	Multi-agent Based Knowledge Sharing Platform
MAS	Multi-agent System
MSFLB	Market study, Strategic positioning, Functional design, Layout design, Business plan
NGOs	Non-governmental Organizations
OECD	Organization for Economic Co-operation and Development
PEST	Political, Economic, Social, Technological
QA	Quality Assurance
RFID	Radio-frequency Identification
SBSC	Sustainability Balanced Scorecard
SCLP	Specialized Committee for Logistics Park
SECI	Socialization, Externalization, Combination, Internalization
SEJ	Seven-Eleven Japan
SMEs	Small and Medium Enterprises
SWOT	Strengths, Weaknesses, Opportunities, Threats
UNECE	United Nations Economic Commission for Europe
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific

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CHAPTER 1

Introduction

1.1 Background and motivation

With the increasing globalization of industry and trade, freight and logistics are quickly changing. Containerization is rapidly gaining importance, which is highly relevant to the huge trading volume. The cost of moving containers to or from seaports constitutes a large part of transport cost. Thus, the “inland leg” becomes an indispensable part of the supply chain concerning the operational efficiency and total supply chain cost (Beresford, et al., 2012). The logistics sector and its impact on the regional competitiveness are receiving more attention at all levels of government and society than ever. According to the 2012 Logistics Performance Index (LPI) survey conducted by the World Bank, China’s LPI ranked 26th in the world. This exhibits more efficient logistics in China than others over the previous three LPI surveys (Arvis, et al., 2012). However, in the face of rapid expansion of the country’s industry and the rise of domestic consumer market, the room for improvement in logistics performance is particularly required (KPMG, 2008). The share of total logistics cost to China’s Gross Domestic Product (GDP) remains high at about 18% compared with 8-9% in most developed countries. More efficient logistics is desired to offer competitive advantages for industrial and regional growth.

The mounting pressure from negative externalities is challenging most city life in China, e.g. traffic congestion, air pollution. The traffic networks have witnessed growing congestion with the huge increase in vehicle numbers in recent years. As a consequence, the “last-mile problem” hinders the city logistics, resulting in higher transport cost, worse traffic condition, and deteriorated urban space. Moreover, the air pollution in cities is gaining more attention. In January 2013, Beijing and many other cities in China were hit by terrible air pollution, which was one of the worst periods of air quality in recent history. Extensive haze, low clouds, and fog covered these air-polluted regions for several days disturbing the industrial production and daily life of residents there. The fact is that automotive emissions have become a major contributor to the air pollution. Thus, adapted solutions are in urgent need to reduce traffic flow and optimize freight routing.

Today consumer behaviours are changing toward a strong uptick in online shopping, personalized demands, and rising expectations on quality, safety and after-sale services.

Companies tend to outsource their logistics activities to the third party logistics providers (3PLs) so as to conform to such trends. Promisingly, 3PLs will provide the backbone of logistics services in the near future, although they only hold a small market share in China now. 3PLs are still small-scale with limitations in functions. They are facing problems relating to cost and reliability of services, professionalism, IT implementation, and infrastructure. A concentrated platform for logistics activities is imperative that not only shares investment cost but also provides more market opportunities for 3PLs.

Logistics sector is expected to offer benefits in terms of productivity, efficiency, and sustainability. The importance of freight villages (FVs) greatly grows as they can generate substantial benefits to meet the expectations, such as supply chain management efficiency, intensive logistics service provision, modal shift, regional growth and employment, and eco-friendly outcomes. The FV practice has been well explored in Germany, Italy, Netherlands, Spain, etc. Such countries still place emphasis on FV development due to potential effects of FVs in addition to reducing transport cost, e.g. consolidated transportation, sustainable city logistics, and intermodal transport. In recent years, FVs arise in some developing countries particularly in China.

Providing freight transfer facilities (intermodal connections), warehouses, distribution centres, and related services through clusters, FVs are able to maximize the logistics efficiency and minimize negative externalities especially traffic congestion and air pollution (ESCAP, 2005). Furthermore, FVs contribute to the improvement of economic activities and employment, as well as the income enhancement at the regional level (Holtgen, 1995; S. Kapros & Joignaux, 1996; D. Tsamboulas, et al., 1997). On the other hand, FVs are potentially polluting mainly due to the greenhouse gas (GHG) emission, noise, and air pollutions resulting from their transport-related activities and 24h-operations. In addition, FVs attract and cluster a wide range of freight and logistics companies. Corporate social responsibility (CSR) encourages these settled companies to take into account the aspects of sustainability in their economic activities. Accordingly, sustainable FV concepts in this research have twofold meanings including sustainable development of FVs and sustainability contributions they created. Regarding this, the sustainability performance can be an ultimate objective which FVs' operators and decision makers (e.g. transport agents, warehouse providers, forwarders, and FV Management Company) should pursue.

The motivation of this research comes from the current situation of FV development and the logistics sector in China. Compared with those countries where FVs have been

profoundly explored, China has showed a more recent but quicker story. FV project is regarded as a key program and edited into country-level strategies. They have greatly increased in number over the past 15 years, and many successful stories appear. However, FVs in China are facing a series of bottlenecks. In some cases they are far away from sustainable development from the start, which are resulted from a pure focus only on the economic outcome. In detail, the FV concept is often mistaken for “economic development zone” or “industrial centre”, and some FV projects even turn into real estate business. FV developers in some cases did not consider intermodal connections when designing their projects. Even in some cases huge size and the number of FVs are regarded as governor performance factors which local governments pursue. Improper site selection results in disturbances to the neighbourhood, i.e. the residents and ecological environment. Furthermore, the sustainability performance should be an important consideration, since inherently FV is a logistics phenomenon with broad economic, social, and environmental consequences. Therefore, sustainable FV concepts make for positive outcomes in the three aspects. What is more, nowadays agricultural products logistics (APL) and city logistics issues are drawing much attention and they are often discussed together in China. Thus sustainable FV concepts particularly focus on APL in this research so as to exhibit the functions of FVs in practice.

The planning stage of FV projects is a technical and political process characterized by knowledge intensive activities. For the purpose of sustainable development, it requires optimal use of land, proper design of infrastructure and buildings, and effective layout of functional zones, etc. Knowledge management (KM) can meet such requirements since it is a proper approach to create and locate knowledge. It manages knowledge flows and ensures that the knowledge can be used effectively and efficiently for the long-term benefits of an organization (Darroch & McNaughton, 2002).

Besides the planning stage, there are also major obstacles during FV operations which hinder to achieve sustainability performance. These obstacles are both conceptual and practical. There is a lack of a systematic approach toward sustainable FVs in the existing literature. In line with the knowledge economy, a key source of sustainability is driven by the solution including creating, sharing, and utilizing knowledge. This research fills such a research gap with KM approaches from the perspectives of FV planning stage and operations. Another important reason to adopt KM is that China’s logistics sector and FV development needs a knowledge environment. The knowledge environment should be helpful to spread knowledge and share valuable experiences concerning the logistics filed,

use state-of-the-art technologies, and raise logistics practitioners' educational attainment. In this way, a well-performed logistics sector will not be far away.

1.2 Research question

In the face of growing attention given to sustainability and the problems exhibited during FV development in China, new challenges are proposed, in particular, how can FVs support logistics-related activities in meeting the sustainability-oriented objective?

In order to pursue this question, the following subordinating questions do surface:

- (1) What is the sustainability-oriented objective in the context of FVs?
- (2) Are FVs actually necessary in China? If so, how can FVs fit the current situation of logistics sector in value creation? In other words, what are the directions for the next development step of FVs to break through present barriers and limitations?
- (3) Why KM approaches can enable FVs to reach the sustainability-oriented objective? And how to do that? To this end, the applications of KM approaches focus on the planning stage and operations of FV projects.
- (4) How do FVs lever Chinese APL to pursue its sustainability? And how to use KM methods researched in question (3) in FV project planning and operations relating to the APL area?

1.3 Contributions

The contributions of this dissertation are summarized as follows:

- (1) From the point of view of FV's double nature, it points out twofold meanings of sustainability in the context of FVs and identifies the involvement of sustainability-related issues;
- (2) It explores the relationships among knowledge, KM, and sustainability performance;
- (3) Considering the current situation of logistics sector and FVs in China, it investigates if FVs are really adapted to the social needs since some problems arise. After that, this research gets the answer that FVs are quite necessary in China as well as identifies several orientations for the future development of FVs;
- (4) In response to the common phenomena of inadequate planning work of FV projects in China, this research adopts the "sense-making KM" approach including sense making, knowledge creation, and decision making to guide a systematic planning process;
- (5) It identifies the need to integrate knowledge and KM in improving FV sustainability

performance during operations; structures a roadmap for organizing KM processes; highlights three key elements including human ability, stakeholder engagement, and information system for the success of using this roadmap; and provides a checklist for building FV sustainability capability;

- (6) Sustainable FV concepts are applied in Chinese APL development. This application is a comprehensive involvement of logistics and sustainable FVs concepts, status quo of logistics sector, freight-related urban problems, KM approaches, and the roadmap. Regarding the issues such as “last mile freight”, food safety, unfair farmers’ income and unstable retail prices, urban air quality, it formulates an integrated logistics system to readjust supply chains of agricultural products and lever APL sustainability.

1.4 Dissertation organization

The dissertation organization is shown in Figure 1-1. Chapter 2, 3, 4 explore the research background in both theory and practice. In Chapter 2, the definition and functions of FVs are introduced in detail, as well as the sustainable features of FVs are explored. Then, Chapter 3 reviews the literature of knowledge and KM, and finds their relationships with sustainability. The role of KM in sustainability balanced scorecard is discussed and knowledge types concerning sustainable FVs are identified. Chapter 4 examines the adaption of FVs to China’s logistics situation by PEST analysis. The history and current status of Chinese FVs are analyzed, and several orientations are proposed based on the fishbone diagram and SWOT analysis. Chapter 5 structures a scheme of FV planning steps toward sustainable development. In particular, the “sense-making KM model” is used to guide FV project planning work following the route: sense making, knowledge creation, and decision making (Choo, 1998). Chapter 6 analyses KM characteristics in the context of logistics and FVs and clarifies how KM process acts on FV sustainability performance. It proposes a roadmap of organizing KM process for sustainable FV operations. Moreover, key elements including human ability, stakeholder engagement, and information system are discussed in detail. Chapter 7 comprehensively integrates the topics especially sustainable FV concepts studied in previous chapters into APL in China. It focuses on the potential sustainability contributions created by FVs which can benefit farmers, customers, and city logistics. KM approaches to FV planning and operations are applied for better APL development. The dissertation is concluded and future research work is discussed in Chapter 8.

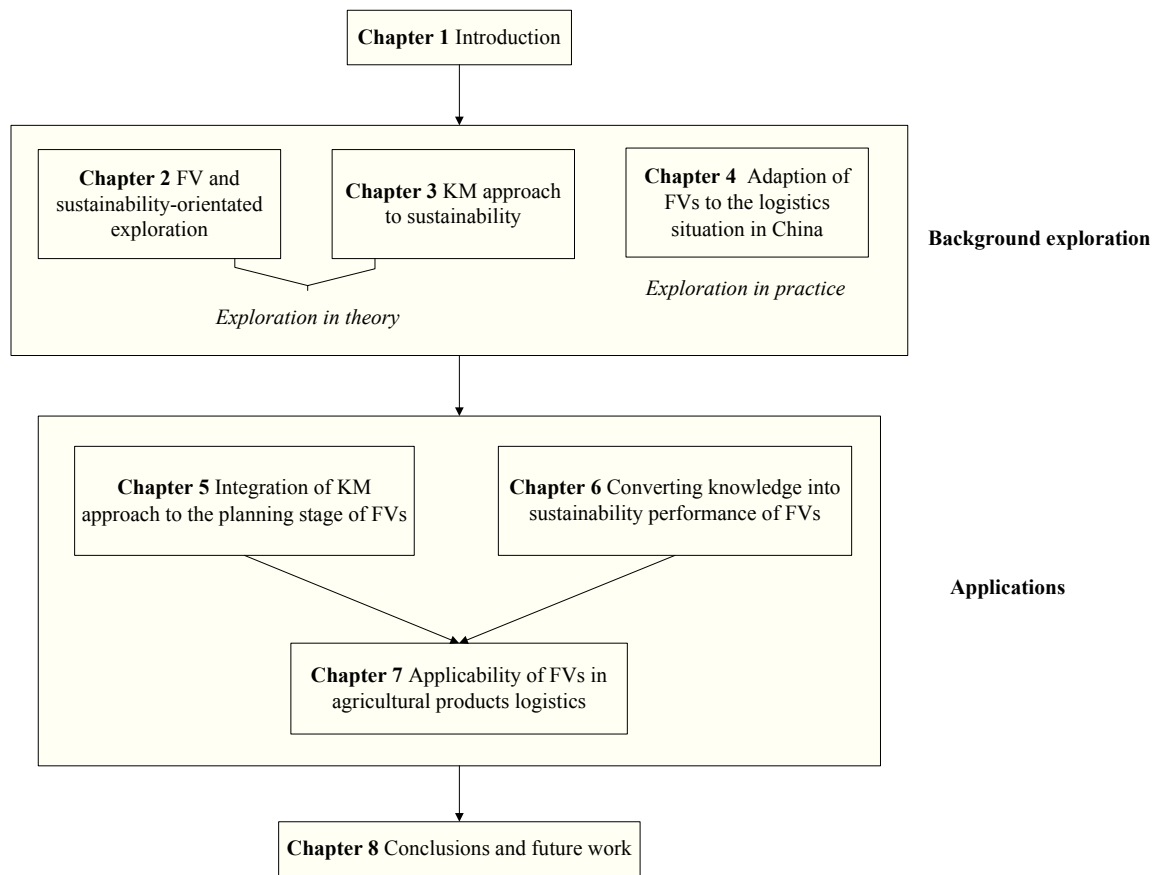


Figure 1-1 Outline of dissertation

CHAPTER 2

Freight village and sustainability-orientated exploration

The importance of FVs greatly grows, due to the changing freight and logistics process characterized by containerization, globalization, third party logistics, and intermodal transport. FVs have emerged around the world as a new generation of intermodal logistics and distribution facilities, in response to the challenges posed by regional population and freight growth (Higgins & Ferguson, 2011). FVs are recommended as eco-friendly solutions to support green logistics and environmental supply chain management. They also help to promote economic growth within a local, regional, national, or even global economy. Therefore, FV is a promising facilitator in developing sustainable transport and logistics industry. Regarding these functions, sustainability performance gradually becomes an important evaluation criterion concerning FVs functions.

2.1 Freight village in concept

2.1.1 Definition

FVs are widely used in trade and transport all around the world. In international bibliography, the term “Freight Village” is often used interchangeably with the terms: “Gueterverkehrscentren” in Germany, “Plateformes Multimodales/Logistiques” in France, “Interporti” in Italy, “Logistics Park/Logistics Centre” in China, or even with the more general term “Dry Port” and “Inland Port”, etc.

FV is accepted in this research as the unified name to describe those key nodes where the transshipment of goods from one mode to the other takes place. It represents a principal component in the logistics system with a cluster of logistics-related enterprises (D. A. Tsamboulas & Kapros, 2003). Intuitively a FV consists of several buildings and handling places surrounded by traffic areas and directly connected to external roads, railways, waterways or airports (Gudehus & Kotzab, 2009). A number of definitions exist in the literature to describe what specially constitute a FV. Here are some classic and most cited definitions of the FV concept:

The European Association of FVs (Europlatforms) (2004) presents the FV concept as “a defined area within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various

operators”.

United Nations Economic Commission for Europe (UNECE) (2001) defines a FV from the cluster perspective: “geographical grouping of independent companies and bodies which are dealing with freight transport (e.g. freight forwarders, shippers, transport operators, customs) and with accompanying services (e.g. storage, maintenance and repair), including at least a terminal”.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2007) regards a FV as “an area of land that is devoted to a number transport and logistics facilities, activities and services, which are not just co-located but also coordinated to encourage maximum synergy and efficiency”.

Three important guiding elements of the FV concept are pointed out by Europlatforms: territorial planning alongside infrastructure rationalization, transport quality, and intermodality development (Higgins & Ferguson, 2011).

UNESCAP (2009) identifies three distinguishing features of the FV concept: an intermodal terminal that is connected to major freight corridors; a nearby seaport, shared access to other facilities, equipments and services; a centralized management and ownership structure.

Figure 2-1 describes the typical constitutions of a FV, which are identified by Association of German FVs (Deutsche GVZ-Gesellschaft mbH) (DGG, 2009):

- (1) Spatial concentration of independent transport-oriented companies, logistics (e.g. distribution, warehousing) service providers and logistics-intensive trade and production enterprises in an industrial estate
- (2) Intersection of two or more different transport modes, in particular road and rail by an intermodal terminal
- (3) Interface between local traffic and long-distance traffic
- (4) Logistics facilities and service stations are provided
- (5) A local FV developer/operator plays the role of management facilitating the cooperation between settled companies

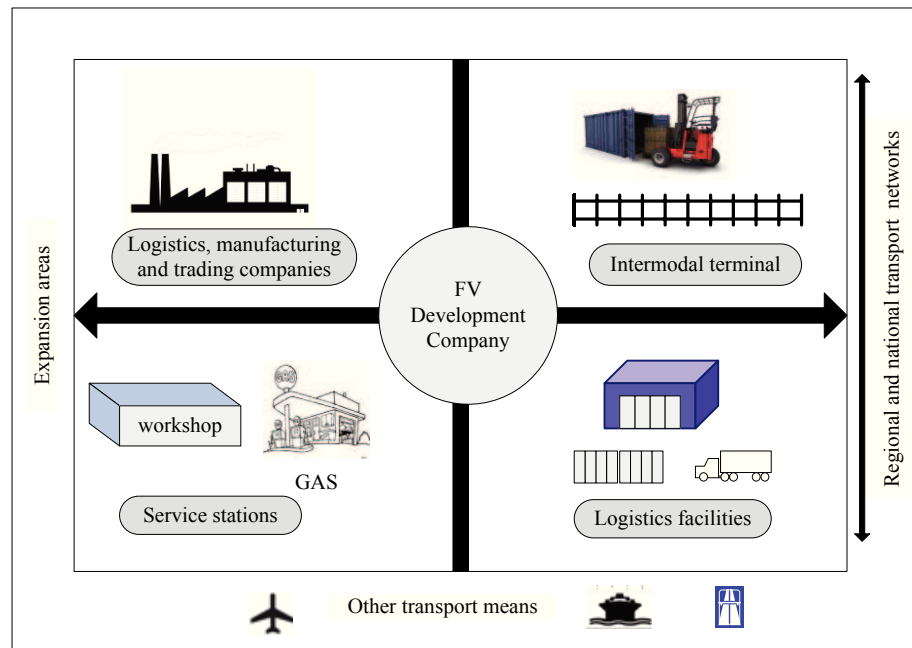


Figure 2-1 Typical constitutions of a FV

Source: Knieriem & Nobel (2011).

The “intermodal terminal” concept is highlighted by the definitions mentioned above. Intermodal terminal is regarded as a necessary component of a FV which offers intermodal transport. Intermodal transport means “the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport (rail, sea, air, inland waterway), without moving the goods themselves in changing modes” (ECMT, 1993). It offers manufacturers a full range of transport modes and routing options, allowing them to coordinate supply, production, storage, finance, and distribution functions to achieve efficient relationships (Rondinelli & Berry, 2000).

In conclusion, there are three basic components constituting a FV: infrastructure, services, and actors.

(1) Infrastructure

Infrastructure in FVs mainly includes logistics-related infrastructure and community infrastructure. Logistics-related infrastructure can be warehouse, transport terminal, distribution centre, storage area, transshipment facilities, information-based facilities, vehicle maintenance place, custom district, etc. Community infrastructure refers to office building, hotel, bank, conference centre, employee housing, etc.

(2) Services (Rimienè & Grundey, 2007)

Typical logistics service and value-added service are offered by FVs. Typical

logistics services include receiving, storage, order picking, break-bulk, freight consolidation, containerization, cross-docking, 24-hour accessibility, etc. Value-added services cover total logistics management, inventory control and tracking, packaging, labelling, bar coding, procurement and vendor management, customer service functions (e.g. returns, repair, rework, and assortment promotional assembly), etc.

(3) Actors

Owners/managers (ultimate project owner), potential users (transport companies, forwarders, 3PLs, and shippers), other transport actors (e.g. railways, port authorities), local authorities (surrounding municipalities), special interest groups (professional chambers, social organizations, interest groups) (Seraphim Kapros, et al., 2005).

2.1.2 From the perspective of industrial cluster

As most researchers defined, a FV is “a cluster of freight-related business”. FVs exhibit many of the similar advantages that industrial clusters do. In consequence, understanding FV functions from the perspective of industrial cluster can be an entry point. Figure 2-2 depicts the relations between FVs and general industrial clusters.

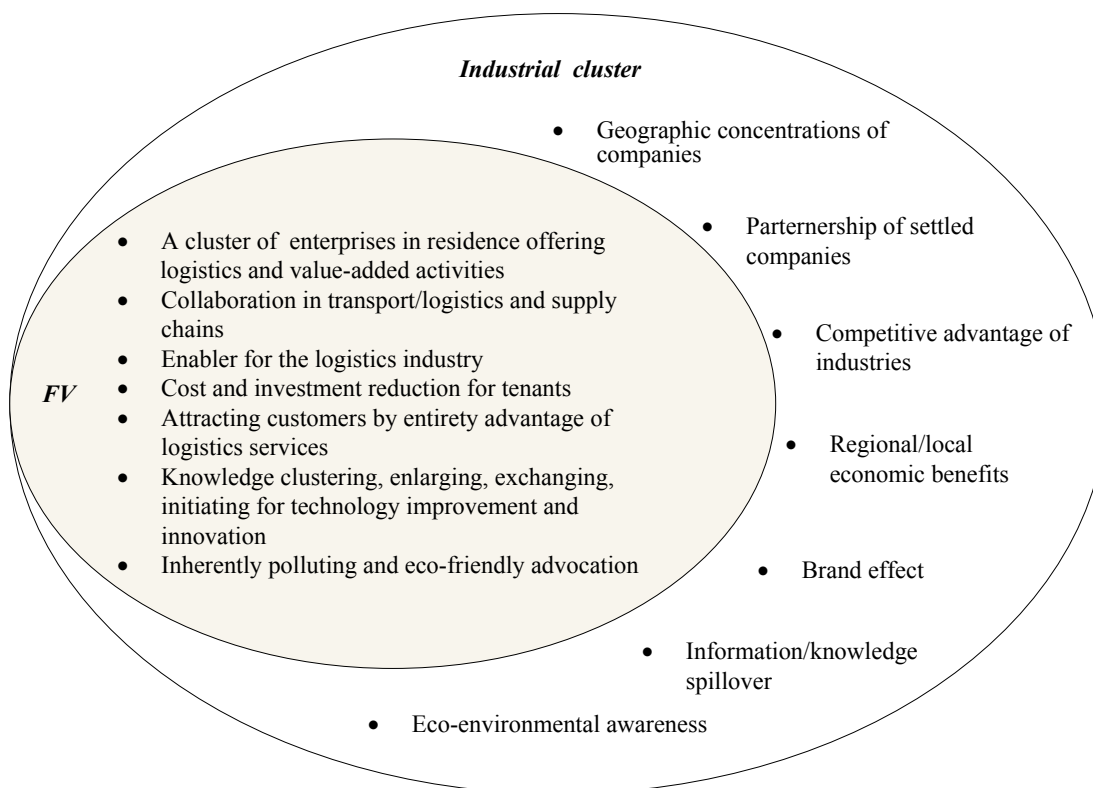


Figure 2-2 Similarities of FVs and general industrial clusters

The common functionalities of FVs and general industrial clusters are detailed from the following aspects:

(1) Companies clusters

Usually an industrial cluster involves a number of companies of a certain industry and its supporting industry, e.g. chemical industry, petroleum industry, automotive industry, food industry, paper industry. A FV owns the basic attribute of an industrial cluster, namely, at least it is a cluster of related companies in a certain area. FVs cluster enterprises relating logistics and added value services provisions for a better performance of the overall supply chain (Veenstra, et al., 2012). These enterprises may be terminal operators, freight forwarders, information service providers, infrastructure managers.

(2) Partnership of settled companies

Concerning the cost reduction and business chances increase, creating opportunities for the partnerships among involved companies is one of the main purposes to generate an industrial cluster. In partnerships the tenant companies try to keep their independence, while simultaneously collaborating for more synergic effects. Similarly, FV is able to enable collaborations among its settled companies based on the shared resources. The collaborations also exist between different inside sectors such as processing, distribution, warehousing, and packaging. A study of the European Union (EU) done in 7 European countries found that 79% of the companies who have their base inside a FV. These companies declared that they collaborated with more than one “neighbouring” companies inside the FV (Europlatforms, 2000).

(3) Competitive advantage of industries

Nowadays, small and medium enterprises (SMEs) are hard to gain competitive advantages in the face of intense market competition and globalized challenge. Under such a situation, individual companies cluster together for the economies of scale and network effects. FVs and various logistics clusters promote trade flows by funnelling them into specific corridors. This generates scale economics by means of freight concentration and traffic consolidation (Roso, et al., 2009). Clearly, FVs contribute to competitive advantages in logistics by the consolidation of procurement, inventories, and distribution, as well as by the number of FVs between delivery points and receiving locations (Gudehus & Kotzab, 2009).

(4) Regional/local economic benefits

Industrial clusters become the regional economy’s dynamism, as they can drive

regional and local economic development. FVs are built coming with the expectation of promoting regional economic activities (Rimienė & Grundey, 2007). FVs initiatives have a positive impact on the regional and local growth directly and indirectly. Positive effects raise the level of international trade, but also attract a great number of associated distributors and manufacturers (ESCAP & KMI, 2008). A report of “Ranking of European FVs 2010” highlighted that the excellently performed FVs in Germany were based on their high job-creation impacts. For example, the outstanding performance of the “Berlin Süd” FV, which has nearly 4,000 employees, underscores its exceptional quality and dynamic impact on economic development (DGG, 2010).

(5) Brand effect

The word “reputation” was once used to describe the whole cluster brand image developed during the industrial cluster growth (Porter, 1990). Definitely, any industrial cluster expects a strong brand to attract potential clients. Hence, building brand value of FVs is effective to generate long-term synergies. To improve the competitiveness of the whole cluster, FVs pursue an increase in their brand value through meeting customer’s needs, improving the accessibility of products to markets as concerns logistics cost, time and reliability (Nathanail, 2007).

(6) Information/knowledge spillover

Information/knowledge spillover is one of the key enablers of industrial growth, which brings the exchange of competition information about markets, technology, products, etc. It can also reduce cost by saving enterprises’ time spent in relevant searching (Y. Liu, 2008). External companies are more difficult to learn from other companies, to sell/buy parts and recruit workers with desired skills (Otsuka, 2006). Besides, tight networks provide learning opportunities for accessing available knowledge, resulting in the collective learning, learning cost reduction, and more innovations. Knowledge activities (e.g. knowledge clustering, enlarging, exchanging, initiating) can greatly contribute to the technology use and innovations of resident firms in FVs.

(7) Eco-environmental awareness

Eco-environmental awareness is gradually raised in industrial clusters in response to the advocacy of “sustainable development” and “cooperate social responsibility” in business. Both of the academia and the industry have proposed a wide range of eco-activities and eco-concepts to help industrial clusters reducing externalities, such as eco-design (Lewis, et al., 2001), eco-efficiency, minimization of environmental impacts,

social and environmental audit, accounting and the expansion of the life cycle products (Neto, 2010). FVs inevitably should take into considerations of eco-environmental awareness and measures in their operations. Green logistics involves measuring the environmental impacts of different distribution strategies, reducing the energy usage in logistics activities, using sustainable transports and green packaging, reducing waste and managing its treatment (Sbihi & Eglese, 2010). In addition, city ecological environment depends on the effects generated by FVs to some extent. If FV projects are properly established and managed, these effects will turn up, e.g. road congestion alleviation, CO₂ emission reduction, reuse of Brownfield and waste field.

2.1.3 Review of FV functions

A FV is more than just a traffic terminal. Different FVs may have different missions while they adhere to the general functions. In terms of FV functions, there are numerous explorations in the literature.

Teo & Goh (2001) point out three key functions of a FV: (i) reduction in facility investment cost, (ii) improvement of service quality, and (iii) lower total inventory cost.

Rimienė & Grundey (2007) identify four main functions of a FV: (i) consolidate a range of logistics and ancillary activities at one site, (ii) contribute to combined transport, (iii) promote regional economy, and (iv) improve land use and local distribution.

Grabara, et al. (2010) conclude FV functions into: (i) transshipment of cargo transfer from multiple suppliers, (ii) storage of cargo from multiple vendors and intended for several audiences, (iii) chapter and completing cargoes destined for multiple recipients, (iv) transportation, especially to consumers; treatment of materials, (v) packing, which results in transport units and storage, (vi) corrective services, and (vii) acceptance of returns and complaints, cleaning containers, etc.

FVs offer opportunities in such aspects: (i) lever freight operations to create local economic value, (ii) create shared value-support business serving the FV and surrounding communities, (iii) primarily use private funds for local community development, (iv) reuse Brownfield properties, and (v) encourage multimodal freight use (Strauss-Wieder, 2008).

Jordan, et al. (2006) extend FV functions to: “(i) relieve the roads from goods traffic and promote the use of eco-friendly carriers (e.g. rail, waterway), (ii) efficient interchange of transport carriers from containers, swap containers, and semi-trailers, (iii) overnight delivery between individual FVs via nationwide FVs networking, (iv) ecological concerns,

e.g. relief of the inner city from the heavy goods traffic, and (v) economic effects, e.g. saving of lead-time and subsequent costs”.

Higgins & Ferguson (2011) provide two different ways to look at FV functions: (i) as transport infrastructure, serving both regional intermodal transport as well as urban consolidation and distribution, and (ii) as promoters of business and economic activity, due to the features of clustering and synergies.

Nestle (2012) highlights four aspects of FV functions: (i) traffic: avoidance of unnecessary journeys of goods shipping, reduction in total shipping cost, shifting between different areas or modals, (ii) economy: logistics services provision, regional industrial productivity enhancement and economic structure optimisation, (iii) ecology: reduction in CO₂ emissions by combined transport and mobility, and (iv) development planning: relocations of distributed logistics facilities and chances for town planning activities.

2.2 Sustainability features of FVs

2.2.1 Sustainability trend

Sustainable development often looks at three major aspects of development including sociological, ecological, and economic dimensions. Adhering to sustainable development, companies can gain long-term competitive edge, increase market share and shareholder value. The term “sustainability” was coined as early as 1980 by three entities: United Nations Environmental Programme, International Union for Conservation of Nature and Natural Resources, and World Wide Fund for Nature (IUCN, et al., 1980). The emergence of the “sustainable development” concept is a shock for the traditional operation philosophy which purely focuses on the financial profit maximization. The challenges from climate change, energy shortage, and creating wealth for an increasing world population will rather broaden the need for sustainability management, sustainable supply chain management and governance in the near future (Vermeulen & Seuring, 2009). Governments have brought sustainability into their planning and policy making. Citizens have been informed of the importance of participating in reducing emissions, saving energy, renewing urban spaces, and other programs (Strange & Bayley, 2008).

Recently, sustainable logistics management has appeared as an answer to a gradual societal response to the unsustainable logistics phenomena. It is concerned with producing and distributing goods in a sustainable way, taking environmental and social factors into account (Sbihi & Eglese, 2010). Sustainable development of the logistics

industry will stay high on the agenda, for companies, consumers, non-governmental organizations (NGOs), and governmental agencies. Moreover, 3PLs and freight forwarders are often to be found at the centre of ecological debate. It is crucial that logistics service should be compatible with a responsible ecological framework and the quality of life of future generations.

2.2.2 Sustainability goals of FVs

The eco-friendly/sustainability function of FVs is indeed regarded as a strategic objective both by researchers and practitioners. Numerous evidences can be found to support this claim.

When talking about “sustainable logistics”, FV concept is pointed out as one of the two discussions, and the other one relates to the long-term innovation and visionary strategy (Boulton, 2008).

According to the statement of Europlatforms (2000), FV is inherently characterized by ecological and sustainable functions: “optimize area utilization”, “safeguard the environment (moving the heavy traffic from residential areas to the Logistics Centre)”, “optimize logistics chains, lorry utilization, warehouse utilization, manpower organization”, “a decrease in the total transport costs, total industrial costs, and personnel costs, etc”.

One goal of the FV development is to relieve the roads from goods traffic and promote the use of eco-friendly transport carriers such as rail and waterway (Jordan, et al., 2006). Urban freight transport contributes to the economic function of a city, it also creates externalities, e.g. congestion, noise, and hazardous situations (Vleugel, 2004). The Organisation for Economic Co-operation and Development (OECD) regards urban freight consolidation and distribution as one of the most important techniques for improving the sustainability of sites and urban (OECD, 2003). Owing to the intermodality, urban transport route optimization and transport companies collaboration, FVs provide the opportunities for urban freight and distribution consolidation. Furthermore, Visser, et al. (1999) point out that the goals of FVs include the improvement of urban environment, reduction in local pollution, traffic noise and the consumption of urban space for transport infrastructure.

In addition, FVs mitigate negative impacts to make themselves be more compatible with neighbouring land users. They are thought to maximize efficiency, at the same time minimize externalities such as urban congestion and air pollution (Bentzen, et al., 2003).

Wisetjindawat (2010) explicitly gives the FV goals according to the three aspects of the sustainable development scheme:

- Environmental aspect, less emissions and noise, usage increase of better environmental transport modes (i.e. rail and inland water)
- Social aspect, considerations in terms of health and safety, less congestion, and more efficient services
- Economic aspect, reduction in vehicle trips and kilometres, reduction in the unit cost, opportunities of revenue by avoiding empty returning trucks

Besides the evidences provided by the literature, this research discovers the reality in the following real examples in which sustainability is considered as a strategic goal:

Interporto Bologna (in Italy) project was the result of many public goals, e.g. promote intermodal rail transport to reduce heavy truck traffic in the city, improve urban goods distribution, and facilitate environmentally sustainable economic development (Boile, et al., 2008).

GVZ Bremen (in Germany) was initiated by a desire to reduce heavy truck traffic and increase intermodality.

The major goal of GVZ Berlin-Brandenburg project (in Germany) is environmental and urban-compatible. It offers the transport industry an eco-friendly and economically feasible solution for all supply and disposal tasks.

Being a “freight city”, Alliance Texas project (in US) is a finest and special example of how industrial, commercial, institutional, and residential activities can be located in close proximity to one another without conflicts.

Nodric Transport Centre (in Denmark) relocated freight facilities out of cities to improve the environment and safety, and support business.

2.2.3 Twofold meanings of sustainability

The double nature reflects that the corporation and public nature of FVs both exist. This indicates that FVs are potentially polluting meanwhile providing opportunities for sustainability outcomes. Accordingly, this research extends sustainability in the context of FVs to twofold meanings beyond the sustainable development of them, but also the sustainability contributions they created.

(1) Corporation nature

Corporation nature means FVs inherently are business units similar to general enterprises, namely, they engage in goods trade and services, or both to consumers by

consuming certain resources (Sullivan & Sheffrin, 2003). Although a FV is constituted by a cluster of firms, it acts as a corporation with a range of business activities and corporate structure. As discussed above, business activities of the so-called corporation for a FV usually include (un-)loading, sorting, processing, labelling, packaging, warehouse, and shipping. FV Development Company plays the role of management layer, and any involved enterprise can be a part or department.

Regarding the corporation nature, FVs are expected to operate in a sustainable way such as green cargo using, eco-buildings, green package, reverse logistics, sewage treatment, emission reduction, green space, qualified working conditions and wages for the staff. Any FV starts out by making its own agenda. Nevertheless, the majority of them have the similar goals including earning money, gaining logistical value, and minimizing cost. If the lower environmental impacts are overlooked, it seems unpromising to sustain the long-term competitive advantage. According to the Intergovernmental Panel on Climate Change (IPCC, 2007), the logistics sector is a major source of CO₂ emission, accounting for 13.1% of global GHG emission. Transport particularly threatens the ecological environment. A significant and growing share of total CO₂ emission and air quality pollution are resulted from freight transport. Since the status quo will result in an increase in congestion and pollution, also will ultimately threaten the competitiveness of Europe's economy, the White Paper - European transport policy for 2010 advises EU to focus on efficient transport so as to ensure its prosperity (Lammgård, 2007). In this report, less congestion, fewer emissions, more employment and economic growth are explicitly raised (Commission & Transport, 2001). Several goals are set for a competitive and resource-efficient transport system, in order to achieve the target of 60% reduction in GHG emission. They are summarized into the following three approaches (Commission & Transport, 2001):

- Develop and deploy new and sustainable fuels and propulsion systems
- Optimize the performance of multimodal logistics chains, including by making greater use of more energy-efficient modes
- Increase the efficiency of transport and infrastructure use with information system and market-driven incentives

Being the intermodal infrastructure holders and primarily conducting intensive transport-related activities, FVs are obligatory to carry out new forms of transport rules and implement efficient technologies to some extent. Effective ways involve using low emission trucks, reducing empty trips, sophisticated intermodal route planning, etc.

Besides transport, a variety of operations were covered within environmental concerns, e.g. eco-efficient unloading vehicle, green packaging, supervision of waste disposal, and emission control. Concerning the “3R” principles (reduce, reuse, and recycle), resident firms are required to incorporate the sustainability objectives into their daily activities.

(2) Public nature

Public nature means that FV is a logistics phenomenon with broad economic, social, and environmental positive consequences. FV is an environmentally adapted logistics solution. Successful cases in some counties (e.g. Germany, Italy, and Japan) have proved that FVs inherently can contribute to the sustainability of logistics industry and the society. For example, under the pressure of city traffic congestion, the establishment of FVs in Japan focused on the optimizing urban logistics as early as 1960s. In Germany, from 1980s, FVs have become the components of national logistics network and greatly increased the transport efficiency.

As traffic nodes and logistics consolidation centres, FVs play an important role in city logistics scheme. Given that, since 2007, more people live in cities than rural areas, new logistics solutions are needed to avoid congestion, pollution, low supply chain reliability, and growing cost (DHL, 2010).

Figure 2-3 depicts FVs functioning in sustainable city logistics. Supply chains are always more complex because of the localization of new worldwide production centres in the emerging countries. Traditionally, seaports and airports support commercial connections with these production centres. FVs are increasingly used in the more complex and articulated transport-networked supply chains. As the important nodes connecting trans-regional supply chains, FVs optimize slack logistics processes in/to urban areas. Usually FVs locate in suburban areas to link logistics activities for the city delivery, which is a response to the uninterrupted city distribution and traffic decongestion. Furthermore, due to the intermodality feature, FVs are recommended as environmentally friendly solutions in realizing green logistics and supply chain management. The combination of transport modes particularly the use of eco-friendly modes inside FVs leads to a reduction in CO₂ emissions caused by heavy vehicles (Kyriazopoulos & Artavani, 2006). Moreover, FVs provide channels and places for reverse logistics. Reverse logistics aims to recover used products and materials with obvious environmental benefits, which is associated with environmental issues.

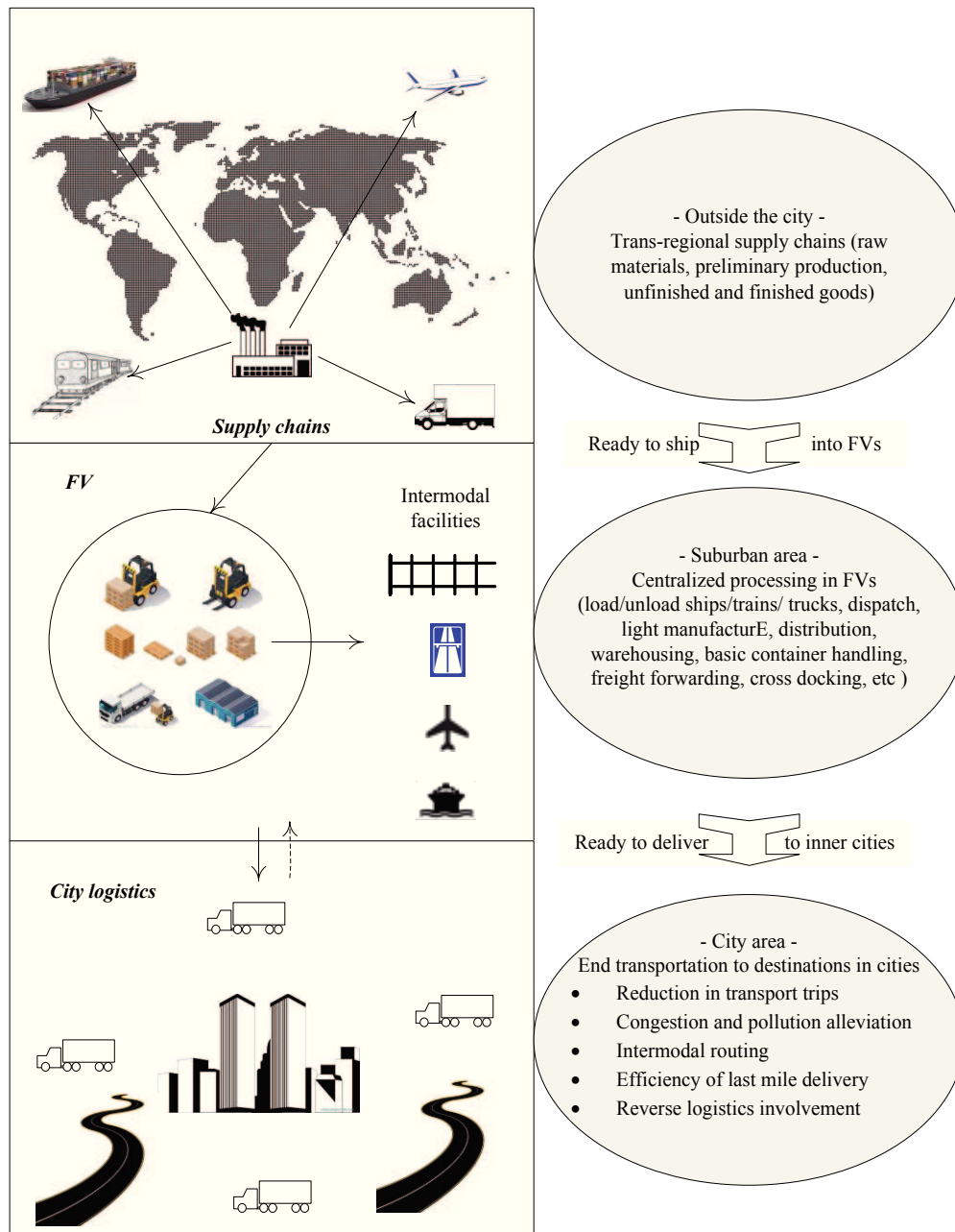


Figure 2-3 FVs functioning in sustainable city logistics

To be more precise, Figure 2-4 describes FV as a key enabler to contributions in the three dimensions of sustainability.

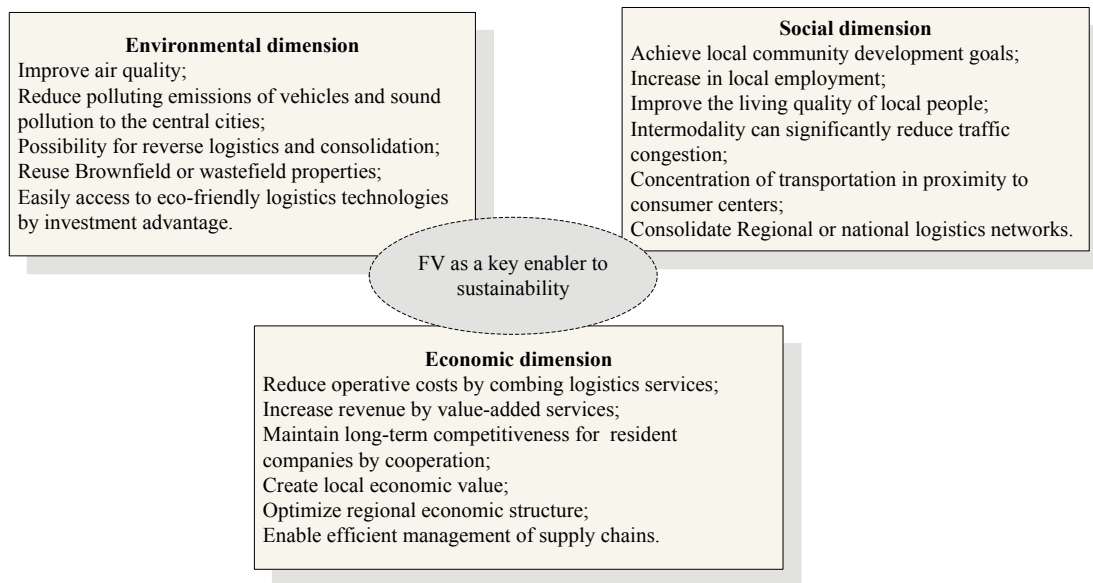


Figure 2-4 FVs' contributions within three dimensions of sustainability

2.3 FVs around the world

2.3.1 European practices

As a well-established concept in Europe, FV has been in operation for several decades there. The early construction of facilities relating FVs can date back to the mid 1960s. After that, successful stories emerged which are regarded as valuable experience for FV development. These FVs are committed to the rationalization of trade flows, combination of transport modes and shipments, uninterrupted city distribution, added-values, and job creation. The networking of FVs has been formed as a broad logistics platform especially in Italy and Germany.

There are various professional organizations in Europe to assist the development of FVs, e.g. European Association of FVs, Association of Centres of Transport of Spain, Association of Danish Transport Centres, Association of German FVs, and Association of Italian FVs (Boile, et al., 2008).

DGG carried out an investigation into the development level of European FVs based on a questionnaire with 29 assessment criteria. This investigation gave a comprehensive comparison of FVs for the first time. FVs from over 30 Europe-wide countries were included. It aimed to provide more transparency of FV development to international logistics sectors and related industries, as well as build a networking linking these FVs based on better knowledge and information about individual market positions and strategies (Nobel, et al., 2010).

Up to now, there are more than 100 FVs in Europe, and about 70 FVs were involved in this benchmark study. One of the most valuable outcomes was the ranking of these FVs and their individual performance scores (maximum performance score: 250 points). Table 2-1 shows the Top 15 FVs resulting from this investigation (A: Austria, D: Germany, E: Spain, F: France, I: Italy).

Table 2-1 Top 15 FVs in Europe

Ranking	Location	Score
1	I - Interporto Verona	211
2	D - GVZ Bremen	209
3	D - GVZ Nürnberg	205
4	I - Interporto Bologna	202
5	E -Madrid CTC-Coslada	199
6	I - Interporto Torino	198
7	I - Interporto Nola Campano	195
8	I - Interporto Parma	190
9	E -ZAL Barcelona	189
10	D - GVZ Berlin South	188
11	I - Interporti Padova	187
12	E- Plaza Logistica Zaragoza	186
13	A- Cargo Center Graz	182
14	D - GVZ Leipzig	175
15	F- Delta 3 Lille	174

Source: Nobel, et al. (2010).

According to these scores, FVs in Italy, Germany, and Spain performed better since the top 10 FVs are dominated by the three countries. The following examples are some of the front-runners of FVs in Europe. The overview of these examples consists of four FVs currently in operation: Interporto Verona and Interporto Bologna in Italy, GVZ Bremen in Germany, and Madrid CTC-Coslada in Spain (see Table 2-2).

Table 2-2 Examples of European FVs

	Interporto Verona	GVZ Bremen	Interporto Bologna	Madrid CTC-Coslada
Size (acres)	618	895	1,055	267
Modes	Road, rail, air	Road, rail, water, nearby air	Road, rail	Road, nearby rail, air
Employee	10, 000	8,000	1,500	8,000
Firms	110	150	100	150
Location features	Directly connected to the Verona Villafranca airport, it is located at the intersection between the Brenner (north-south) and Serenissima (east-west) turnpikes	In suburban Bremen, in the middle of three major harbours in Bremerhaven, Wilhelmshaven, and Hamburg, connected to two highways and one main road, with an inland waterway siding	In suburban Bologna, 12 km from the city centre, direct connections with Italy's highway network and rail routes, proximity to commercial district	7 minutes from the centre of Madrid, 2 km from Abronigal railway station and 10km from Barajas international airport
Description	Started from the late 1960s, managed by the Consorzio Zai with detailed plan approved by the Veneto Region, a front-runner in Italy and has also been recognized as NO.1 FV in Europe, support for the production linking loaders, forwarding agents, and logistics services providers, has developed an agro-industrial centre and telematic network	Established in the 1985, the earliest FV in Germany, it is a successful case; it was developed by a public private partnership, synergies among tenants companies are developed, a high rail share of traffic into and out of the facility (Boile, et al., 2008), operate toward logistics-intensive production and food wholesalers (http://www.via-bremen.com/64_2)	Started in the 1970s with the collaboration between public authorities and private operators, represents an appealing feature for national and international actors and makes this area more competitive, outstanding features of railway infrastructure and traffic-connected warehouse facilities	Created in 1991, Spain's first integrated logistics platform, developed by the most important agents within the community, both public and private; the initiative goal is converting Madrid into the largest logistics platform in southern Europe; works toward the optimisation and planning of logistical resources

2.3.2 North American and Asian practices

Besides the ongoing development of FVs in Europe, they are also implemented and widely accepted in North America. Asian countries such as China, Singapore, South Korea, and Thailand have cases of FV construction, among which FV projects are drawing much attention from the government in China. Some representative FVs in North America and China are respectively overviewed in Table 2-3 and Table 2-4.

Table 2-3 Examples of FVs in North America

Names Items	AllianceTexas Fort Worth, TX (USA)	Raritan Center Edison and Woodbridge, NJ (USA)	Pureland Industrial Complex, NJ (USA)	CentrePort (Canada)
Size (acres)	17,000	2,350	3,000	20,000
Modes	Rail, road, air	Rail, road	Rail, road	Road, rail, air, linking to water
Tenants	170	131	150	150
Services	Office, residence, hospital, education, retailing, mall, entertainment, hotel	NJ Convention Centre, post office, medical centre, bank, hotel, restaurant, day care	Office, hotel, restaurant, supermarket	Land, office, air cargo operations

ESCAP is committed to develop an intergovernmental agreement on FVs in Asia. FVs have been high on the ESCAP agenda for some time. A series of projects related to FV development and intermodal transport were carried out (ESCAP, 2010):

- “Integrated international transport and logistics system for North-East Asia” (2002-2005)
- “Promoting the role of the Asian highway and trans-Asian railway: intermodal interfaces as focus for development” (2006-2008)
- “Operationalization of international intermodal transport corridors in North-East and Central Asia” (2008-2010)
- “Development of dry ports along the Asian highway and trans-Asian railway networks” (2010-2012)

In addition, ESCAP has published the following work to share knowledge about FVs and intermodal transport:

- “Policy Framework for the Development of Intermodal Interfaces as Part of an Integrated Transport Network in Asia” (ST/ESCAP/2556)
- “Logistics Sector Developments: Planning Models for Enterprises and Logistics Clusters” (ST/ESCAP/2457)

- “Transport and Communications Bulletin for Asia and the Pacific, No. 78 Development of Dry Ports” (ST/ESCAP/SER.E/78)

In short, FVs in North America tend to be larger than European’s, but less in number. Asian FVs emerged in great number particularly in China. The FV project is regarded as a strategy for the logistics sector development in some countries such as Germany, Italy, and China. Various national and international associations are working toward FV development including establishing networking, promoting infrastructure construction, providing information, sharing knowledge, and benchmarking.

Table 2-4 Selected existing FVs in China

Cities	Name	Predominant type	Size (ha)
Shenzhen	West harbor FV	International logistics	40
	Yantian harbor FV	International logistics	50
Shanghai	Waigaoqiao FV	International logistics	120
	Southwestern comprehensive FV	Regional logistics	100
	Northwestern comprehensive FV	Regional logistics	133
Ningbo	Main FV	International logistics	80
	Zhenhai FV	International logistics, regional express	30
	Cixi FV	Regional express, urban distribution	30
	Jiangdong FV	Urban logistics, distribution	20
Nanjing	Longtan FV	International harbour logistics	100
	Lukou FV	International airport logistics	70
	Changjia zhuang FV	Regional logistics	50
	Wangjia wan FV	International and domestic logistics	74
	Najing industrial chemical FV	Regional logistics	50
Suzhou	Suzhou High & new tech FV	International logistics	20
	Weiting FV	International and domestic logistics	40
	Lumu FV	International and domestic logistics	20
Beijing	Huatong FV	International and domestic logistics	39
	Beijing Airport FV	International and domestic logistics	63

Source: Tao (2009).

2.4 Summary

This chapter reviews the definition of a FV and FV practice in Europe, North America, and Asia. It explores the sustainable features of FVs. The involvement of sustainability issues in the context of FVs is clarified. Sustainability is extended in the context of FVs to twofold meanings beyond the sustainable development of them, but also the sustainability contributions they created. Attaching the sustainability sense to FVs’ operations is essential to bring about competitiveness for their tenants, a higher level of stakeholder satisfaction, and the efficiency of logistics sector as well as city logistics.

CHAPTER 3

Knowledge management approach to sustainability

Knowledge management (KM) is a planned, structured approach for systematically and actively managing insights, ideas, information, and knowledge of employees. It is probably the most important and powerful form of leverage for accelerating an organization proceeding toward sustainability. KM is becoming a guiding philosophy of business today, since organizations are being advised to sustain competitive by efficiently and effectively create, locate, capture, and share knowledge and expertise (Zack, 1999). KM may influence strategies making and conducting in an organization. This is due to a growing importance of intangible assets and knowledge, and the fact that knowledge rather than physical capital, is the driving competitive force for companies (Schaefer & Harvey, 2000).

3.1 Knowledge and knowledge management

3.1.1 Knowledge and competence

In the knowledge-based economy, knowledge has become a crucial asset for business and other activities. In general terms, knowledge can be perceived as any piece of idea, insight, know-what, know-how or meaningful information that can be used to achieve an objective (Wong & Aspinwallb, 2006). Knowledge is often embedded in documents or repositories. As “a fluid mix of framed experiences, values, contextual information, and expert insight that drives the strategic realization of an organization”, knowledge is also implanted in “organizational routines, processes, practices, and norms” (Davenport & Prusak, 1998).

In fact, both the concepts of knowledge and information are frequently used interchangeably throughout the literature and praxis (Kakabadse, et al., 2001). Knowledge is often viewed as an understanding of information based on its perceived relevance and value to a given domain or problem. Actually, knowledge is made of information, which implies much better perceptions of a situation, causal phenomena, technologies application, and the theories and rules in operating. As a result, inherently the understanding of knowledge cannot be immune from information, since it is “a step ahead

of information” providing a higher level of meaning than information (Segev, 2010). Through a series of value-adding processes (e.g. capturing, gathering, converting, and compensating) dealing with information, knowledge is produced and then can be used to enable the working process or actions to be at an optimal level. Similarly, Drucker & Ferdinand (1989) regard knowledge as information and it can change something or somebody, due to the fact that knowledge can be “grounds for actions” or “make an individual or an organization capable of different or more effective actions”.

There is a variety of knowledge taxonomies in literature and praxis, and several representative ones are introduced here: (i) one of the most cited taxonomies is the distinction of tacit and explicit knowledge (Polanyi, 1964). Tacit knowledge refers to the awareness of things characterized by subjective, cognitive, experiential, and taking long to learn, involving expertise and high level skills. While explicit knowledge is the knowledge that has been documented and codified which can be readily transmitted to others and do not need interpretation. It is objective, technical, rational, formalized, and capable of being clearly stated. Traditionally organizations merely recognized and managed explicit knowledge; (ii) general knowledge, specific knowledge, and expert knowledge are concluded as a kind of knowledge taxonomy (Schank & Abelson, 1977). General knowledge is applicable to a wide variety of tasks, including information about or interpretation of human intention, disposition, and relationships; specific knowledge describes the knowledge which is applicable to all tasks in a particular situation; expert knowledge is factual knowledge as an extensive database about life matters; (iii) Nonaka & Takeuchi (1995) distinguish technical knowledge from cognitive knowledge to extend Polanyi’s opinions to a more “practical” stage. Technical knowledge represents “knowledge-how” and cognitive knowledge refers mental models. In addition, three distinct types of organizational knowledge including systemic, socio-political, and strategic knowledge are identified (Evans & Easterby-Smith, 2001). Consequently, it should be noted that knowledge taxonomy is not unified and it can be determined according to the real context.

Knowledge is not an elusive concept; actually, is a kind of pragmatic resource which is bound up with an organization. It has been a crucial asset related to but differing from tangible assets, monetary assets, and the traditional accounting concept of intangible assets (Kirsch, 2008). Hence, from the strategic perspective, knowledge asset is resource which can potentially support and drive the improvement of organizational performance. Knowledge asset is defined as “any collected information or any type of knowledge held

by an organization, and used by anyone affiliated with the organization to help the organization achieving its goals” (SMR, 2008). They may include stakeholder relationships, valuable information, technology knowledge, skills, customer loyalty, know-how, employee competency, trust, and experience (Kirsch, 2008). As such, knowledge asset stands for the sustainable competitive advantage at the strategic level. As a result, by developing and exploiting organizational knowledge assets, a company is able to create value for its stakeholders.

3.1.2 Knowledge management

The value realization of knowledge and knowledge assets depends heavily on how well such intellectual capital is managed. The ability to lever organizational expertise is a critical success factor in most forms of knowledge work. KM is a method of systematically and actively managing insights, ideas, information, and practical know-how for creating values from an organization’s intangible assets.

The basic understanding of KM consists of three dimensions: (i) a set of processes including creating, acquiring, organizing, applying, sharing, replenishing (Yang, et al., 2009), (ii) a collaborative environment is highly needed to undertake such processes, and (iii) KM must encompass people, process, culture, and technology.

KM can be found in almost every type of organization today: government department, food sector, supply chain management, medical practice, chemical and pharmaceutical company, healthcare, school and library, construction project team, etc. Meanwhile, KM has been rooted in a broad range of disciplines such as business transformation, intellectual assets, learning organization, knowledge based system, information management, and innovation (Suresh, 2001).

As a result, KM can be defined and understood varyingly. It is involved in various areas with different focuses:

- (1) KM is discussed in different ways including economic level, firm level, and strategic level (Armistead, 1999) (see Table 3-1).
- (2) From a broad perspective, Wiig (1997) provides a range of KM focuses and goals at different societal and enterprise levels: national-wide focus, enterprise-wide focus, value chain focus, process and practices focus, work function focus, and detailed knowledge focus. They share common goals related to maximizing success, supporting value increase, and better performance by KM implementation.
- (3) Ståhle (2003) points out that KM can be approached from four different perspectives:

philosophic perspective (explaining the knowledge term), organizational growth perspective (mobilizing knowledge assets and systematically managing them to improve performance), business perspective (converting knowledge into profits), and technological perspective (efficient and effective tools for knowledge-related activities).

Table 3-1 Discussing KM in three ways and supportive literature

Levels	Goals	Literature
Economic level	“A knowledge age to follow”; “industrial age where knowledge is a limiting resource rather than financial resource”	(Norman, 2002) (Lundvall & Rodrigues, 2002) (Powell & Snellman, 2004)
Firm level	“A shift from a focus on resources, as in the resource-based view of the firm”; “innovation and technological breakthrough of a firm”	(Conner & Prahalad, 1996) (Alwis & Hartmann, 2008)
Strategic level	“Core competence which might give the firm sustained advantage over its competitors through their use in processes”	(Teece, 1998) (Boisot, 1998) (Massa & Testa, 2009)

KM identifies and levers the collective knowledge in and around an individual or organization, so as to increase values and competitiveness. In the context of a company, its overall performance depends on the extent to which managers can mobilize all the knowledge resources held by individuals, teams, and surroundings. As well as it relies on the ability of converting these mobilized knowledge resources into value-creating activities (von Krogh, 1998).

In recent years, KM has become one of the frequently discussed topics among academic and practitioners. It especially draws considerable attention of people who work in the information-related and human resource management arenas (Prusack, 2001). KM aims at scanning and translating operational environments, creating capabilities associated with knowledge and expertise, as well as accessing, formalizing and using experience. The ultimate objectives of KM include effective problem solving, superior performance, profitable innovations, and customer value.

Wiig (1997) discerns the four areas of systematic KM from a managerial perspective: “(i) top-down monitoring and facilitation of knowledge-related activities, (ii) creation and maintenance of the knowledge infrastructure, (iii) renewing, organizing, and transforming knowledge assets, and (iv) leveraging (using) knowledge assets to realize their value”.

In implementing KM, a range of technological tools are indispensable. Table 3-2 identifies three types of tools as the enablers of KM, so as to build a firm’s core capability.

Table 3-2 Tools for KM implementation

Tools	Functions	Examples
Capture tools	“Acquiring, codifying, and storing structured and explicit knowledge”	Intelligent databases Note-capture tools Electronic whiteboards Associated DBM Intelligence tools Collaborative filtering Data web-houses
Communication tools	Enable viewing of documents irrespective of their formats, operating systems, or protocols	Intranets Knowledge maps Face-to-face communication Multimedia tool, e.g. videoconferencing
Collaboration tools	“Promote knowledge creation and transfer through informal talk and discussions” (Tiwana, 2002)	Virtual meetings Document collaboration Informal communication tools Groupware

Source: Daghfous (2003).

3.1.3 Knowledge-based view as a basis for sustainability

Figure 3-1 illustrates the evolution of knowledge-based view as the foundation for sustainability performance. In general, a firm's assets can be categorized into tangible assets and intangible assets. Tangible assets are considered the goods of material nature which can be perceived by senses, comprising physical and financial assets, e.g. raw materials and stocks, furniture, machines, lands, money. Intangible assets are considered the goods of immaterial nature, goodwill, and intellectual property, e.g. the science of knowing what to do, relations with the clients, operative processes, the technology of information and databases, capacities, abilities, and innovations of the employee. Intellectual property is usually referred to as knowledge assets, which comprises human capability, structural capability, and relational capability.

It has been argued that “the terms of intangibles, knowledge assets, and intellectual capital can be used interchangeably and they all refer essentially to the same thing” (Lev, 2001). Regarding a firm's knowledge assets, human capital (skills, experience, expertise, motivation etc.) is much potential for future success, which may be the most important and critical for competitive advantage as it is the most difficult to imitate (S.DeNisi, et al., 2003). Structural capital is related with organizational business routines, which covers methods, concepts, processes, and rules, etc. Embedded within environments, the relational capital consists of culture and the stakeholder relationship with customers, suppliers, research institutes, investors, ecological environment, and communities. The resource-based view indicates that valuable, rare, hard to imitate, non-substitutable

resources are the source of competitive advantage through building operational capabilities for a firm (Barney, 1991; Wernerfelt, 1984).

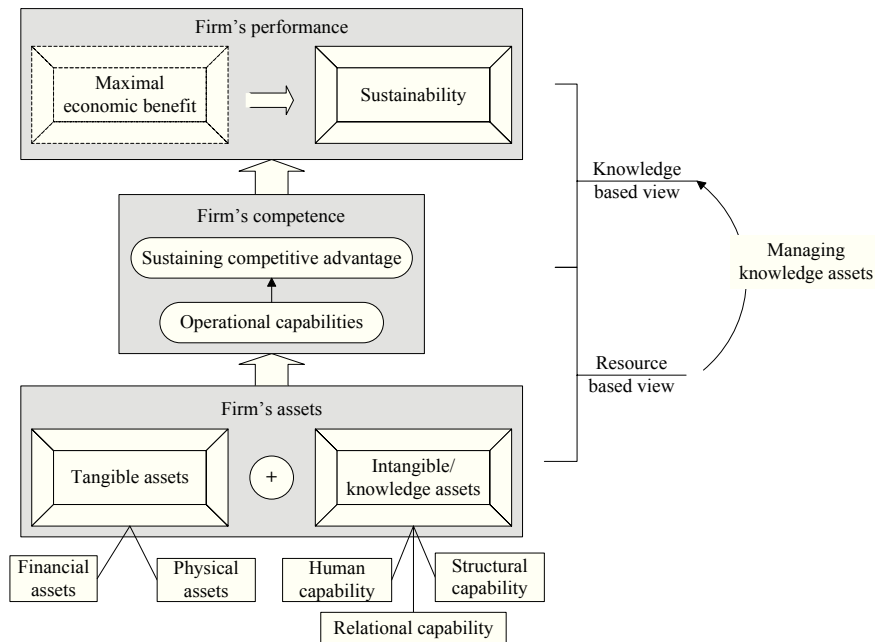


Figure 3-1 Evolution of knowledge-based view in sustainability performance

In order to sustain competitive advantages, maximal economic benefit was always pursued as ultimate objective by firms in the past. Nevertheless, with the promotion of sustainability perception and enriching corresponding regulations, a firm's performance is breaking through the "maximal economic benefit" to "sustainability". This shift is a strategic blueprint concurrently outlining the evaluation and implementation of economic techniques encompassing the environment, individuals, communities, and the society (Tenuto, 2007). Corporate sustainability focuses on the parameters within entire product lifecycle such as sourcing production materials, manufacturing, marketing, packaging, and disposal. In addition, stakeholder relationships and reputation are indispensable elements within the scope of corporate sustainability.

Due to the complex involvement of information or knowledge within the theme of sustainability, actions concerning knowledge assets management allow the conceptual transmission from resource-based view to knowledge-based view, thereby obtaining sustainability benefits. These actions can be effectively realized by KM. The rationales for investing in KM for sustainable development purpose are listed as following (Creech & Willard, 2001):

- Fill the knowledge gap that inhibits policy development from sustainability
- Generate recommendations that will fast track innovation for sustainability

- Resolve current frustrations resulting from inadequate or inappropriate policy development and implementation
- Learn from each other across sectors and regions about best practices

3.2 The role of KM in sustainability balanced scorecard

3.2.1 From BSC to SBSC orientating corporate sustainability

Orienting sustainability, the sustainability balanced scorecard (SBSC) concept is offered which is developed from the traditional balanced scorecard (BSC). Since the creation of BSC concept in the early 1990s proposed by Kaplan and Norton, it has evolved from a performance measurement tool to a strategic management system. The sequence of BSC is designed as following aspects (Gminder & Bieker, 2002):

- Learning and growth perspective, priorities to create a climate supporting organizational change, innovation, and growth
- Internal/business process perspective, strategic priorities for various business processes, enabling customer and shareholder satisfaction
- Customer perspective, strategy for creating value and discrimination
- Financial perspective, strategy for growth, profitability, and risk from the perspective of shareholders

For some years, the concept of BSC has been discussed because of its potential to integrate environmental and social concerns into the core process of an organization. Gminder & Bieker (2002) discusses how the tool of BSC can be used for the management of sustainability in general and CSR in particular. Integrating sustainability into BSC not only exists in literature, but also appears in practice. Companies such as Lunds Energi, Novartis, Novo Nordisk, and Shell are documented to use BSC also carry out environmental and social programs (Zingales & Hockerts, 2003).

Basically, there are three possibilities to integrate environmental and social concerns into BSC: (i) environmental and social aspects can be integrated in the existing four standard perspectives, (ii) an additional perspective can be added to take environmental and social aspects into account, and (iii) a specific environmental and/or social scorecard can be formulated (Figge, et al., 2002). This research adopts the SBSC frame showed in Figure 3-2. The four perspectives are “learning and growth”, “process”, “stakeholder”, and “sustainability”.

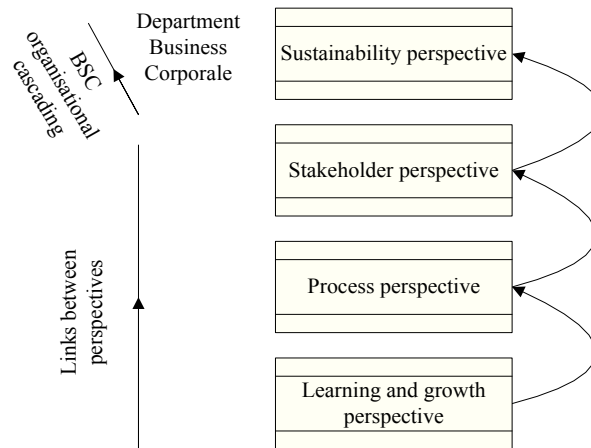


Figure 3-2 Cascading sustainability balanced scorecard

Source: Dias-Sardinha, et al. (2002).

The learning and growth perspective contains strategic goals that will enable sustainability related knowledge to enter an organization. Such kind of knowledge is learned and spread by organizational learning, thereby arousing the incentive for corporate sustainability. Organizations gain growth by creating a culture to support organizational change, innovation, and staff skills improvement.

The process perspective drives products and services to a more sustainable way throughout their entire life cycle. It enables more efficient production processes and the creation of better products by competitive products and services in the market (e.g. offering environmentally and socially sound products).

From the sustainability perspective, companies take into account not just their customers but also other stakeholders. Thus, the customer perspective in traditional BSC is redesigned to the stakeholder perspective. The fulfilment of stakeholders' expectations may adjust a company's desire to behave as a good citizen. This is guided by high moral and ethical principles. For example, non-government organizations such as environmental groups engaging in environmental protection are involved in the stakeholders.

The re-worked financial perspective is broadened to the sustainability perspective depicting "ecological sustainability, human rights, and economic performance". Concerning an organizations' vision and mission, the sustainability perspective is moulded in align with the revolution of resource view.

SBSC allows for cascading from the corporate level to the business unit and to individual departments. They also provide causal links among the four relevant perspectives: learning and growth, process, stakeholders, and the strategic objectives of sustainability.

3.2.2 Implications for sustainability-oriented KM principles

The SBSC formation provides several implications concerning the functions of knowledge and KM, as well as how KM works to enable sustainability performance improvement (see Figure 3-3).

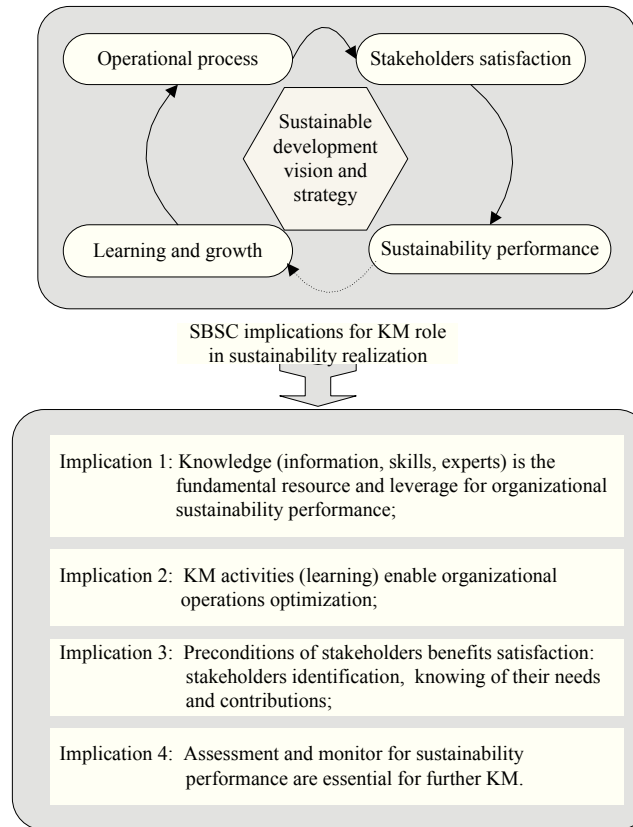


Figure 3-3 SBSC implications for sustainability-oriented KM principles

First, “learning and growth” is always the base for strategic routes, which refers to skills, information, experts, and technologies. It is regarded as a ground of SBSC for organizational growth and the other subsequent perspectives. Second, through a set of KM processes, knowledge assets are able to qualify and optimize organizational performance in both production and service. Third, stakeholder relationships are strengthened by the knowledge network supported by multiple stakeholders’ engagement. This is because that sustainable development is a complex and interactive issue requiring the participation of various related sectors. Fourth, the evaluation of sustainability performance provides the feedback for guiding further KM implementation.

Potential knowledge assets in SBSC fall into four categories (see Table 3-3). “Knowledge in environments” is crucial for strategy forming. Not only the insights about business environment are involved, but also the ecological environment situation and social considerations are necessary. “Knowledge in people” constitutes the foundation of

the strategic implementation. The knowledge in people at organizational level represents corporate values acceptance and organizational culture formation. Individual knowledge concerns the employee's sustainability awareness, knowledge base, and ability level, etc. "Knowledge embedded in processes" is directly relevant with the value realization. It generates benefits to the demand fulfilment, decision making, information system using, and eco-efficiency manufacturing process. A further level of knowledge assets concerning the relationships among stakeholders is identified. Organizations have long recognized that the better relationships certainly lead to better performance. Thus, the approach of multi-stakeholders involvement enables the realization of sustainability-oriented strategy.

Table 3-3 Knowledge assets utilized in SBSC

Category	Subcategory	Description
Knowledge in environments	Business environment	Policy, economy, technology, competitors, market demands and business trends
	Social and ecological environment	Interrelations among economic activities, ecological status, urban life, and social insights
Knowledge in people	Organizational capital	Corporate value notion, organization culture
	Individual capital	Experience, awareness, skills, learning ability
Knowledge in processes	Products and services	Product quality and functions, eco-friendly design and production, green logistics and supply chain management, service capability, value-added services
	Management	Management skills and methods, intelligent management
	Technical process	IT infrastructure, databases, the response rate of system, eco-efficient technologies
Knowledge in stakeholder relationships	External stakeholders	Relationships with customers, suppliers, government, local authorities, communities, special groups
	Internal stakeholders	Interactions among employees, managers, decision makers, intra-segments

3.3 KM for sustainability value of FVs

3.3.1 Responding to the logistics sector

Knowledge is indispensable to the core competency of organizations. Thus, the acquired knowledge needs to be well nourished and managed, and then can be turned to the desired effects. Although this is true for various industries, it is particularly relevant to the industrial sectors where companies have to cope with increased customers requirements, multiple segments involvement, technological breakthroughs, and rising social concerns. The logistics industry belongs to this type of industry due to its great impact on the employment, economic, and sustainable outputs.

Figure 3-4 briefly depicts the evolution of logistics. Three representative trends are identified:

- Solutions covering operational methods, collaboration approaches, stakeholder involvement, and communication channels
 - Past: single-way process, short of flexibility, easily fail
 - Current: networking for multi-channel applications, risk reduction
 - Future: multi-level networking, adequately utilizing resource, better supply chain performance, and social economic efficiency
- Visibility relates to the transparency level of information sharing, process tracing and assessment
 - Past: unknown process, information asymmetry, high-risk
 - Current: a wide range of communication technologies, improved information acquisition and sharing
 - Future: transparent information exchanging, reduction in the administration and planning errors
- Benchmarking mirrors the assessment criteria for logistics performance
 - Past: orienting lower cost, one-sided view, hidden risks, undesirable consequences
 - Current: combined considerations about logistics qualities (time, cost, reliability, flexibility, legitimization, etc.)
 - Future: sustainability considerations, the balance of economic benefit, ecological protection and social welfare

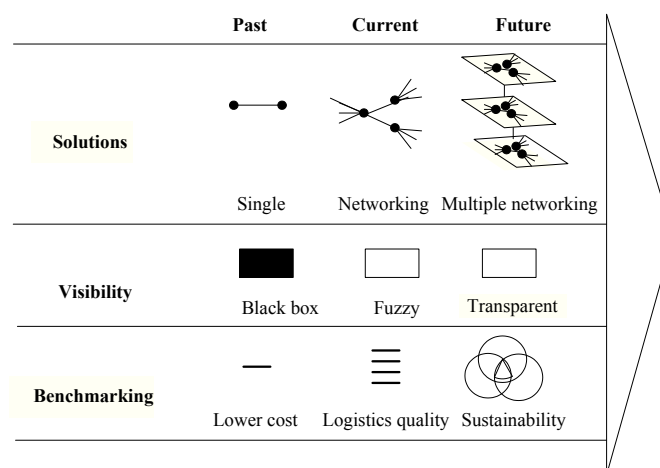


Figure 3-4 Evolution of logistics

The logistics sector tends to be collaborative and cooperative, information/knowledge-based, and sustainability-oriented. This has altered the managerial and

academic communities to understand the significance of how to create and lever knowledge based resources.

Transport and logistics companies as well as international supply chain activities are facing a dynamic and information intensive environment, thus, more and more logistics-related companies involved in KM execution (Hans-Dietrich Haasis, 2008). KM is highly relevant to the logistics and supply chain field for several reasons. Firstly, a supply chain depends largely on the type and quality of collaboration between individual sections and partners based on knowledge sharing, understanding, and trust. Secondly, the right mix of knowledge, experience, and competence of the employee accommodates to the rising technological advances, customer and social expectations. Thirdly, logistics itself is a quite young and developing discipline, which requires ongoing supply of knowledge. Methods, tools, technologies, management skills, logistics education and training are significantly changed in this area (Neumann & Tomé, 2005).

3.3.2 Types of knowledge

Knowledge in this research is defined as useful information or know-how for FVs sustainability-oriented value. Several knowledge types have been introduced, such as explicit and tacit knowledge, technical and cognitive knowledge. In the context of sustainability-oriented FVs, two kinds of knowledge are identified, which are operational knowledge and supportive knowledge (see Figure 3-5).

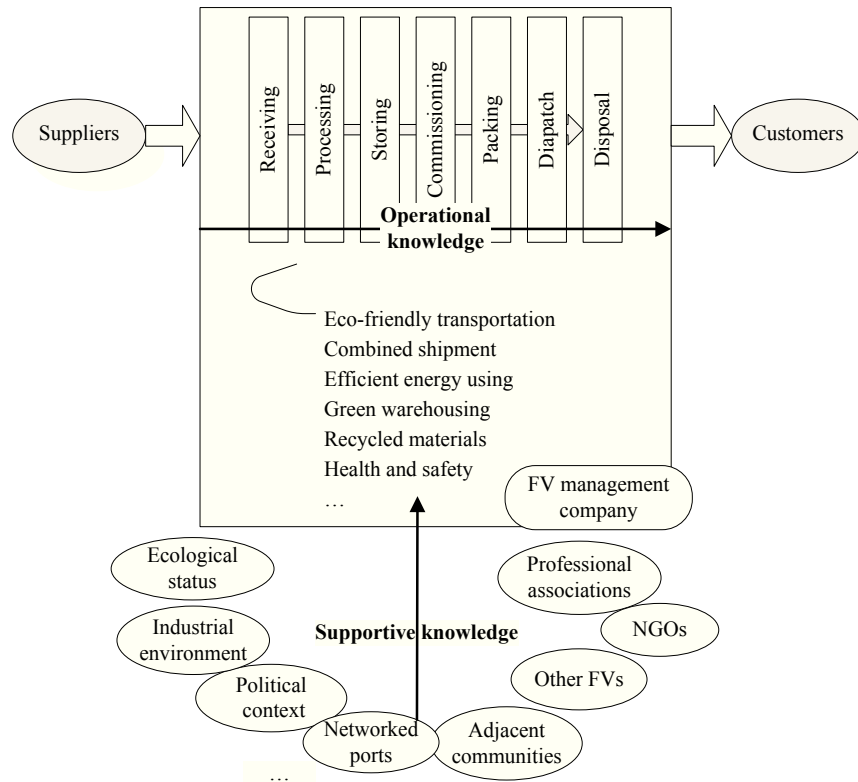


Figure 3-5 Knowledge in sustainability-oriented FVs

3.3.2.1 Operational knowledge

The operational knowledge is defined in line with the typical operations within a FV, which is embedded in such operational aspects: (i) receiving (unloading, entrance control, buffer, un- and repacking), (ii) processing (labelling, quality control, change of load carrier, preparation for storing), (iii) storing (in-storing, keeping retrieval), (iv) commissioning (external/internal orders, shipment/replenishment orders), (v) packing (one- and multi- way, packages/container/pallets), (vi) dispatch (order consolidation, compressing, check out, buffering, loading), and (vii) disposal (packages, empties, waste, returns) (Gudehus & Kotzab, 2009).

The operational knowledge within sustainability-oriented FVs is concerned with the actions such as eco-friendly transportation, combined shipment, efficient energy using, green warehousing, recycled materials using, health and safety.

A FV is mainly an intermodal terminal with regard to the old-fashion definition. Operators lever the knowledge relating to intermodal freight for significant savings potentials compared to the traditional over-the-road networks (Macharis & Bontekoning, 2004). Operational knowledge functioning throughout the internal logistics process chain can build solid relationships based on the transparency and mutual trust between different

logistics segments. In addition, eco-friendly transportation and combined shipment can be better operated by knowledge sharing and using.

Warehousing toward sustainability is also a challenge for the development of warehouse facilities and services. Adequate KM is helpful for organizing high space utilization, efficient material handling, efficient scheduling of loading and unloading, and order picking.

Concerning the value-added services in FVs, packaging is a coordinated system preparing goods for transport, warehousing, sale, and end use. Today packaging is facing the requirements from the sustainability orientation. More and more environmental responsibility and recycling regulations are placed on packaging tasks. Similarly, as a starting point of logistics system, products may be labelled with information presentation about environmental consequences, such as recycled content, biodegradability, toxic emissions, waste generation, harm to wildlife, etc (Banerjee & Solomon, 2003).

Reverse logistics has gained great attention in response to the growing importance of green logistics. It is defined as “the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal” (Hawks, 2006). This definition highlights the linkage between operational sections and the need for information. In this context, activities of reverse logistics require adequate KM support throughout the journey of returned products. On one hand, this may assist to solve problems in all the processes. On the other hand, it may approach the current goals of customer satisfaction and business benefit to the environmental legislation.

3.3.2.2 Supportive knowledge

Supportive knowledge ensures the coordination between internal operations and external environment situations. Sources of supportive knowledge are derived from the policy context, ecological status, suppliers and customers, networked ports, and adjacent communities, etc.

Policy context mainly consists of municipalities such as state government and local municipality. FV development is associated with intervene of governments, ministries of transport, domestic and foreign private investors, and financial institutions. Knowledge existing in the policy context covers the land-use planning, support policies for alternative modes, urban planning, and regulations on vehicle emissions. Such knowledge is

supportive for FV development at the strategic level.

At present, the environmental pollution seriously affects the health and life quality of human. Normally FVs are located at the periphery of metropolitan areas and big cities. Directly connecting to the external roads, they unavoidably disturb the surrounding communities. Friendly relationships between FVs and the ecological environment, adjacent residents, and NGOs can provide long-term development for FVs. These relationships are built upon smooth communications by means of KM approaches.

Cooperation with professional associations and other FVs offers opportunities for FVs to learn state-of-the-art technologies and management skills. FVs can realize their current level of development by exchanging benchmarking information with professional associations and other FVs. In addition, in the FVs network, adequate knowledge sharing results in macroeconomic benefits by solid and mutually beneficial national relationships and even international relations between FVs.

FVs should open up to the information of suppliers (tenants within FVs) and customers. KM enables the coordination of both supply side and demand side through effective sharing of the information held by them. The aim of integrating demand and supply information is to provide competitive advantages of FVs at increasing levels of detail and sophistication. In this way, the information synchronization of markets, operational processes, and end-customers demand can be realized. Also the relationships between suppliers and customers are strengthened by trust. Furthermore, the consolidated shipment relies largely on the trust and rapid information exchange, which leads to a reduction in cost and mitigation of traffic congestion.

The FV management organization plays a vital role in enhancing both operational and supportive knowledge-related activities. In most cases, FV management organization is a limited company supporting the planning process, location, development process, and operating. It also undertakes the tasks such as new tenants acquisition, site marketing, daily site administration, organizing cooperation, organizing staff training, and logistics consultation. Accordingly, KM is necessary for leveraging the two types of knowledge sources toward superior performance of the FV management organization as a whole.

These two types of knowledge help FV operators to adapt themselves to a complex business environment as well as to acquire advanced business skills and methods.

3.4 Summary

This chapter reviews theoretical aspects about KM. The relationship between knowledge and competence is identified. Knowledge asset stands for the sustainable competitive advantage at the strategic level. It analyses the evolution of knowledge-based view in sustainability performance. Much of the work takes the shared concern for the importance of knowledge resource in gaining sustainability. The SBSC tool is used for managing and realizing sustainability and CSR. The SBSC frame gives implications concerning the functions of knowledge and KM, as well as how KM works to adapt to sustainability performance improvement.

Based on the background of knowledge, KM, and their relationships with sustainability performance, this chapter explores KM for sustainability-oriented value of FVs. Several reasons are pointed out for answering why KM is highly relevant to the logistics and supply chain management field. Following that, knowledge relating to sustainability-oriented value of FVs are identified and analysed in detail.

CHAPTER 4

Adaption of freight villages to the logistics situation in China

FVs in a number of countries have been high on the agenda for the logistics sector development during the past several decades. Some countries have rich experience in implementing projects related to the development of FVs and intermodal transport. As a logistics strategy with multi-fold missions, some successful FVs in West European and North American countries have yielded considerable contributions.

In the face of great opportunities and challenges, China's logistics sector is experiencing upgrading. FVs are spreading faster there than anywhere else in the world. The government has been provided strong support for FV projects throughout China. Regarding the detours and obstacles on the way to effective logistics, a doubt is also raised that if FVs are indeed necessary in China. To avoid futile endeavours, it is imperative to consider the adaption of FV development to its current logistics situation.

4.1 Applicability of FVs in China

4.1.1 Current status of the logistics sector

From a worldwide perspective, logistics has been highly relevant to industrial and economic life for many years. In China, the concepts of logistics and logistics management in the research field are relatively new. The fact that it was initially introduced at the end of 1970s. Until the middle of the 1990s, logistics were only limited to the theoretical researches and rarely practiced. Even since then, logistics concepts have been applied in a variety of industries. Currently logistics is a hot point of economic development in China.

Initially logistics was only regarded as transport. Other logistics activities such as storage, processing, packaging and labelling were considered irrelevant activities beyond the logistics field. Nowadays, systematic logistics operations have become a focus point due to the enhanced economic and social benefits. During these years, along with a major shift from fragmented logistics activities to the integrated logistics process, China's logistics sector has received considerable attention from politics as well as the public. Several major features of today's logistics sector in China are analyzed below.

(1) Growing logistics market

The fast development of the Chinese economy has been a significant incentive for the growth of the logistics market in the country. A steady growth of the logistics market is an outstanding feature of its logistics situation. This claim is evidenced by two facts including logistics demand coefficient and increased value of logistics sector.

One piece of the evidence of China's growing logistics market is the logistics demand coefficient. It refers to the share of logistics contribution in GDP (the support of total logistics revenue to each unit of GDP), which has kept climbing in recent years. Figure 4-1 shows the climbing trend of the logistics demand coefficient in China from 2005 to 2011. It grows from 2.6 in 2005 to 3.5 in 2011 despite a slight decline in 2009 due to the worldwide economic crisis.

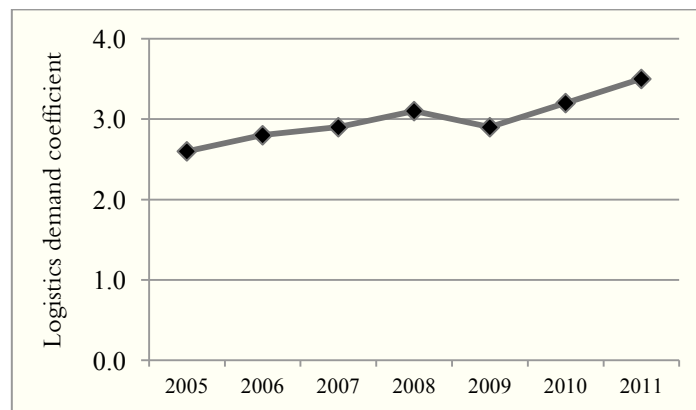


Figure 4-1 Logistics demand coefficient in China (2005-2011)

Logistics revenue is another piece of evidence showing that the logistics market is growing, which represents the core index of logistics performance. It mainly consists of the sources of revenue in transport, storage, wholesale, distribution, packaging, and post. From 2006 to 2011, the logistics revenue grew from 14,120 to 32,168 Billion CNY, and the share in GDP remained stable around 6.8%. Its share in the tertiary industry was about 16% (see Table 4-1).

Table 4-1 China's total logistics revenue (2006-2011)

Year	Revenue ((billions in CNY)	Share in tertiary industry (%)	Growth rate (%)
2006	14,120	17.1	15.1
2007	16,981	17.6	20.3
2008	19,965	16.5	15.4
2009	23,078	16.1	7.3
2010	27,310	16.0	13.1
2011	32,168	15.7	13.9

Source: NDRC & Nankai-Logistics (2011).

(2) Low logistics efficiency

China's domestic logistics sector is facing some bottlenecks. According to "State of Logistics China Survey 2012" organized by the Global Supply Chain Council and supported by CEVA Logistics, the major problems are related to high cost, reliability (services level and professionalism) of local 3PLs, and the quality of transportation. The following two aspects will expose some of these issues.

1) Share of logistics cost in GDP

To a great extent, the total social logistics cost to GDP ratio reflects the efficiency of logistics operations contributed to the economic growth. This ratio in China has remained comparatively high in recent years. According to CEVA Logistics, logistics cost in China is high at 17.8% of GDP compared with less than 10% in most of developed countries, e.g. 7.7% in the U.S., and 7.15% in the EU (see Table 4-2). The logistics efficiency is one of the main challenges along with China's vigorous economic growth.

Table 4-2 Total logistics cost in China (2006-2011)

Year	Total logistics cost (billions in CNY)	Growth rate (%)	Share in GDP (%)
2006	38414	13.5	18.3
2007	45406	18.2	18.4
2008	54542	16.2	18.1
2009	60826	7.2	18.1
2010	70984	16.7	17.8
2011	84025	18.5	17.8

Source: NDRC & Nankai-Logistics (2011).

2) Logistics performance assessment

The LPI indicator designed by the World Bank looks at the logistics efficiency of different economies. LPI measures the logistics performance taking into account of six sub indexes containing customs, infrastructure, international shipments, logistics competence, tracking & tracing, and timeliness (Arvis, et al., 2012). Table 4-3 provides the LPI comparisons among several selected economies.

According to the World Bank (2012), China ranked 26 among 155 assessed economies, showing a little improvement of logistics efficiency as compared with the 2010 record (ranked 27). Customs, tracking & tracing, and timeliness are mainly lagging behind its LPI ranking. On the whole, China is one of the few countries which are the most over-performing non-high-income countries (Arvis, et al., 2012). It indicates that the logistics development environment in China has improved greatly in recent years. It is pointed out that China is among the few countries with a bureau for logistics development, especially the intensified efforts in logistics infrastructure and management system at

country and regional level (Arvis, et al., 2012). However, there is still much room for further improvement regarding some important issues, e.g. standardization, cold chains construction, avoidance of homogeneous competitions among seaports, intermodal transport configuration, socialized logistics platforms, integrated logistics strategies.

Table 4-3 LPI comparisons among selected economies (2006-2011)

Economies	2011	2009	2006
Brazil	45	41	61
China	26	27	30
Germany	4	1	3
India	46	47	39
Japan	8	7	6
Russia	95	94	99
Singapore	1	2	1
South Africa	23	28	24

(3) Rising logistics outsourcing

Logistics outsourcing is gradually rising, which enables greater flexibility, higher operational efficiency, better customer service, and much concentration on core business. Therefore, it is argued that “for many business enterprises, logistics needs to be a core competency and used as a competitive weapon”. Wal-mart, Dell, and Amazon are mentioned as perfect examples of companies who “treat logistics as a key differentiator and leverage point”. Regarding these examples, logistics outsourcing leads them to be front-runners in their own fields (Bramlett, 2012).

In 2011, Chinese National Development and Reform Commission conducted the 9th survey of domestic logistics market collaborated with Modern Logistics Research Centre of Nankai University. It was found that the industrial and commercial enterprises in China are increasingly leaning towards logistics outsourcing. Figure 4-2 shows that 63.3% of the respondent companies outsourced logistics in 2010, while this rate is 42.6% in 2006. Under economic pressure and varying customer demands, logistics outsourcing will be accepted more widely to strength the overall efficiency.

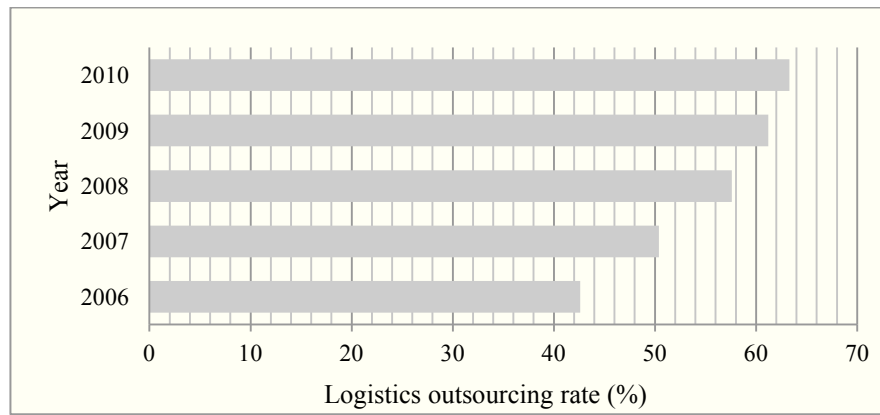


Figure 4-2 Logistics outsourcing of Chinese business (2006-2010)

As shown in Table 4-4, outsourced logistics services cover line haul, delivery, storage, packaging and distribution processing, logistics information management, logistics system design, inventory management and others. In 2010, line haul and delivery were outsourced more than others, accounting for 47.8% and 43.1%, respectively. However, merely 5.9% of inventory management was outsourced. The inventory management outsourcing remained at lower levels in recent years.

Table 4-4 Outsourced logistics services (2006-2010) (including multiple choices)

Services \ Year	2006	2007	2008	2009	2010
Line haul (%)	32.7	30.8	39.3	42.6	47.8
Delivery (%)	25.4	32.1	37.4	38.3	43.1
Storage (%)	15.1	16.7	11.9	15.5	16.3
Packaging and distribution processing (%)	5.2	6.7	11.9	13.5	14.6
Logistics information management (%)	3.5	8.2	17.5	15.6	16.2
Logistics system design (%)	7.9	8.3	10.6	10.7	11.5
Inventory management (%)	9.2	6.4	6.7	5.4	5.9
Others (%)	2.9	1.1	1.2	2.1	2.3

Source: NDRC & Nankai-Logistics (2011).

Currently, the contribution of logistics outsourcing to business competitiveness is still inadequate in China. Accordingly, more logistics outsourcing and the active coordination between 3PLs and business enterprises are required.

(4) Initial step of low-carbon logistics

Low-carbon logistics concerns low energy consumption, low emission, low pollution, and high efficiency in logistics operations. It is especially stimulated by the low-carbon economy advocacy and the official force of Copenhagen Conference on the Environment on environmental protection (Tu, 2010). At that conference, Chinese government claimed to take measures to reduce CO₂ emissions per unit of GDP in 2020 by 40 to 45 percent

compared with the level of 2005. Since then low-carbon economy has been edited into plans at country-level. As per World Economic Forum report in 2009, human activities generate annual 50000 mega tons CO₂ emissions, out of which 2800 mega tons or 5.5% can be assigned to logistics and transport activities (Doherty & Hoyle, 2009). Clearly, the logistics sector bears responsibility for realizing the low-carbon goal.

Usually solutions to the low-carbon logistics are: reducing emissions and energy consumption, upgrading equipments and facilities, exploring sustainable energy sources, optimizing transportation route, and streamlining trade flow with logistics clusters, low-carbon labelling and packaging, etc. Figure 4-3 indicates a slowing trend of the growth of CO₂ emission caused by transport sector in China.

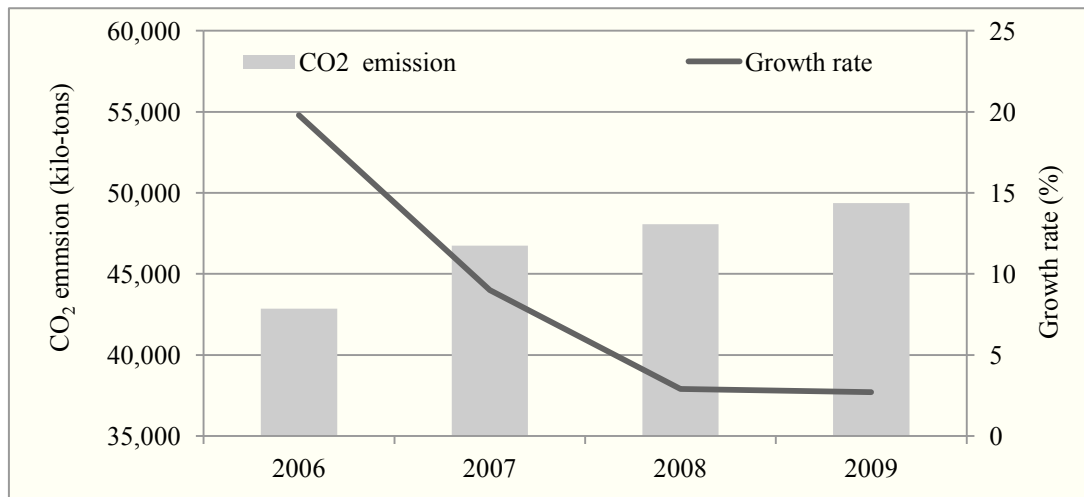


Figure 4-3 CO₂ emission caused by logistics sector in China (2006-2009)

Source: NDRC & Nankai-Logistics (2011).

(5) Intensified efforts in logistics infrastructure construction

As commented by the World Bank, Chinese government intensified efforts to construct the logistics infrastructure resulting in its improved logistics performance. Figure 4-4 depicts the growing trend of China's logistics investment and allocations on commercial, storage & post, traffic.

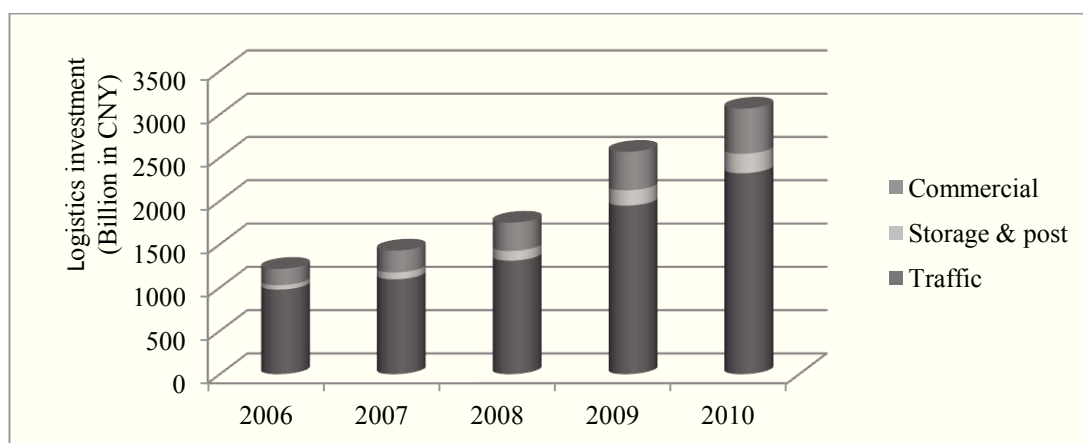


Figure 4-4 China's logistics investments and allocations (2006-2010)

In particular, the investment in traffic infrastructure was increased rapidly. It has brought more new built length of railways, roadways, and increased capability of seaports (see Table 4-5).

Table 4-5 New built length and capability of traffic infrastructure in China (2006-2010)

New built infrastructure	2006	2007	2008	2009	2010
Traditional railway (km)	1605	678	1719	5557	4986
Double tracking railway (km)	705	480	1935	4129	3747
Electrified railway (km)	3960	938	1955	8448	5948
Road (incl. highway) (km)	93720	143595	99851	121013	104457
Highway (km)	4325	8059	6433	4391	8258
Handling capacity of quay (10 kilo-tons)	45726	43916	33099	31318	27202

In addition, the Ministry of Railways issued the “Long-term National Railway Network Plan” pursuing a blueprint of railways with total length of 120,000 km regarding the 12th Five-Year Plan (see Table 4-6).

Table 4-6 China's 12th Five-Year Plan: railway

Items	Objectives
New build length (km) - traditional railway	21,538
New build length (km) - high-speed railway	7,462
Operating length at end of period (km)	120,000
Double tracking vs. total rail length	50%
Electrified tracking vs. total rail length	60%

Source: Stanley (2012).

(6) The ambition of national logistics networking

To sustain the country's long-term economic growth and close the regional economic gap especially between China's east and west, the national government mapped out a country-wide logistics network including nine major logistics clusters, ten major logistics corridors, and a series of logistics node cities.

1) Nine logistics regions (see Table 4-7)

Table 4-7 Nine logistics regions and their hub cities

Names	Hub cities
Northern logistics region	Beijing, Tianjin
Northeast logistics region	Shenyang, Dalian
Shandong peninsula logistics region	Qingdao
Yangtze river delta logistics region	Shanghai, Nanjing, Ningbo
Southeastern coastal logistics region	Xiamen
Pearl river delta logistics region	Guangzhou, Shenzhen
Central logistics region	Wuhan, Zhengzhou
Northwestern logistics region	Xian, Lanzhou, Urumchi
Southwestern logistics region	Chongqing, Chengdu, Nanning

2) Ten major logistics channels

Ten major channels mapped in the logistics networking are: Northeastern-inside Shanhaiguan; North-south logistics channel in east; North-south logistics channel in central region; logistics channel connecting eastern coast and northwest; logistics channel connecting eastern coast and southwest; logistics channel connecting northwest and southwest; logistics channel for sailing in southwest; logistics channel connecting Yangtze River and canals; logistics channel for coal; logistics channel for import and export.

3) Logistics node cities

Logistics node cities in the plan involve 21 national-level logistics node cities, 17 regional-level logistics node cities, and local-level logistics node cities will be confirmed by the local governments.

National logistics node cities are: Beijing, Tianjin, Shenyang, Dalian, Qingdao, Jinan, Shanghai, Nanjing, Hangzhou, Ningbo, Xiamen, Guangzhou, Shenzhen, Wuhan, Zhengzhou, Chongqing, Chengdu, Nanning, Xian, Lanzhou, Urumqi;

Regional logistics node cities are: Harbin, Changchun, Baotou, Hohhot, Shijiazhuang, Tangshan, Taiyuan, Hefei, Fuzhou, Nanchang, Changsha, Kunming, Guiyang, Haikou, Xining, Yinchuan, and Lhasa.

(7) Lacking in logistics professionals

China is still lacking logistics professionals although the government and educational institutions have initiated a host of related education programs. This shortage impacts on a large number of companies that have difficulties in finding qualified logistics professionals. Experienced logistics professionals are in great demand. According to the report in 2010, the top three kinds of sought-after logistics professionals

are people who engage in logistics management, logistics information management, and supply chain design. Such three kinds of logistics professionals are in shortage accounting for 80.1%, 78.3%, 56.9%, respectively. The most urgent demand of China's 3PLs for logistics professionals are experts with integrated logistics management skills and experiences (see Table 4-8).

Table 4-8 Types of logistics professional shortage in logistics companies (2007-2010)

Items \ Years	2007	2008	2009	2010
Integrated logistics management	1	1	1	1
Logistics information management	2	2	2	2
Supply chain design	-	5	3	3
International logistics management	3	4	5	4
Marketing management	-	3	4	5
Transportation management	-	6	6	6
Warehousing management	4	7	8	7
Special operations	5	8	7	8
Others	6	9	9	9

Source: NDRC & Nankai-Logistics (2011).

4.1.2 PEST analysis of the feasibility of FV projects

PEST analysis stands for “political, economic, social, and technological analysis” (Aguilar, 1967). It describes a framework of macro-environmental factors used in the environmental scanning for strategic management involving political, economic, social and technological considerations.

Political considerations are related to governmental activities and to how deep the government intervenes in the economy. Governments carry out rules and regulations that organizations and their customers have to obey. The political factors mainly include tax policy, environment protection law, international trade regulations, consumer law, antitrust law, employment law, and health and safety law.

Economic factors include economic growth, interest rates, exchange rates, government spending and investment, consumer confidence, industrial development, international trade, regional economic gap, etc.

Social factors refer to forces from social cultural aspects, e.g. eco-friendly awareness, health consciousness, urbanization progress, living conditions and threats (traffic congestion, pollutions of air, water, and noise), population growth rate, age distribution, career attitudes and education, emphasis on safety.

Technological factors look at R&D automation, energy using and cost, information

technology reforming, technology infrastructure such as the internet and telephone, mobile technology, technology incentives, and the rate of technological change.

This research scans external environments concerning the logistics sector, so as to analyze the feasibility of FVs in China.

4.1.2.1 Political factors

China has stable environment that is not affected by any significant political crisis and no major changes in political structure are expected in near future. This will bring greater opportunities for the logistics business and a wide range of industries.

The logistics sector development is regarded as a national-level strategy. Accordingly, governments at different levels engage in identifying and implementing policies and guidelines to facilitate logistics development. Here are some cases:

- “Guidelines for promoting modern logistics industry development” (issued in 2004)
- State standard about “Classification and the evaluation index of logistics enterprises” (issued in 2005)
- Document of “Allocation plan of nationwide seaports” (issued in 2006)
- Document of “Mid- and long-term prospects of integrated transport networks” (issued in 2007)
- Document of “Development of logistics system adapting to agricultural products ” (issued in 2007)
- Execution of “Early warning system of logistics industry” (started from 2008)
- “Policies and measures for promoting the sound development of logistics industry” (issued in 2009)
- Two special projects of “Development program of agricultural products cold supply chain” and “National logistics standardization” (issued in 2010)
- “Guidelines for promoting the sound development of logistics industry” by the general office of the central government (issued in 2011)

With regard to the low-carbon economy, the logistics field is attached with much attention. For example, both of “national scheme for climate change” issued in 2007 and “energy conservation law of China” revised in 2007 aim to reduce GHG emission by the country-level policies and strategy. Especially the latter, which supplemented the content concerning traffic energy saving. It encourages the logistics/transport companies to conduct consolidated freight operations. Ministry of Transport and NDRC jointly launched the “promotion of drop and pull transport development” in 2010, in order to

construct a low-carbon and energy-efficient transport system in China.

However, multiple jurisdictions exist and affect the development of logistics sector. Hence the governance and regulations need further progresses and reforms, e.g. high-level coordination among government departments, considered regulations, and adapted standardization on logistics operations.

4.1.2.2 Economic factors

This research identifies several economic factors to prove that a more efficient logistics system is imperative: (i) China's extraordinary economic growth, (ii) ongoing urbanization and industrialization, (iii) the acceleration of domestic consumption, (iv) the rising demand for imported goods, (v) improved infrastructure construction, and (vi) high share of logistics cost in GDP.

Manufacturing can gain efficiency and remain competitive by less logistics cost and more efficient logistics operations. Logistics sector is the basis and also the engine of other industries. Economic gap, especially between east and west China, calls for more logistics accessibilities, so as to benefit the agriculture and manufacture development in western China. In most cases, one of the methods to enhance logistics accessibility is building dry ports, as west China are hinterlands which are far away from the coast. These dry ports are developed to improve the economic development of west China, in response to the "Go West" strategy executed from 2000. Due to the regional development gap between eastern and western China, the "Go West" strategy aims to stimulate the development in underdeveloped western regions. It gives support to the development of infrastructure facilities and industries with unique advantages in the western regions as well as improves the production and living conditions of local residents (hktdc, 2013).

Intensified competitions among seaports are gaining attention today. As a result, seaports have to change their commercial strategies (Beresford, et al., 2012). The interaction between seaports and hinterlands plays an important role in such a competitive situation. Seaports begin to take an interest in inland terminals since they are directly connected to seaports with high capacity transport means. As the extended gates of seaports, container terminals in hinterlands increase more recently for better streamlined shipping flows.

4.1.2.3 Social factors

The first social factor is environmental sustainability awareness. Increase in goods transport volume has lead to more CO₂ emissions as hidden cost. Almost all the economic activities in urban areas rely heavily on the freight system. The problem of last-mile freight in central cities appears along with the intensifying urbanization in most of cities in China, directly affecting the livelihood and liveliness of urban spaces. Limited public space and various negative externalities threaten the liveability, which are drawing considerable attention of the neighbouring communities.

Second, changes of customer behaviours and improved logistics development environment create a promising market for 3PLs. Nowadays Chinese consumer behaviours are changing toward a strong uptick in online shopping, personalized needs, more concerns about quality, safety and after-sale services. Such changes highly promote logistics outsourcing to external partners (i.e. 3PLs), so as to reduce cost, enhance efficiency, and to strengthen the core business. Logistics outsourcing is widespread in China today. However, 3PLs are facing main problems related to the cost and reliability of services, professionalism, IT, and infrastructure.

Third, insufficient supplying of logistics manpower becomes a critical issue. Modern management knowledge and skills of practitioners are needed to satisfy the increasing demanding clients. Taking China express delivery service as an example, there are lots of complaints about its service quality, e.g. parcel damage, lost, late delivery. Although the express delivery segment ranks No. 3 in the world according to the amount of delivered parcels, the low margin compels most 3PLs to save on cost thus the training for their staff is firstly affected (Kearney, 2010).

4.1.2.4 Technological factors

An ideal technological environment is inclined to the use of information technology. Informationalized logistics has drawn extensive attention from governments and large-scale enterprises. Major logistics segments in China such as railway, road, waterway, air, and postal delivery have set up logistics information systems of their own. Logistics departments in enterprises implement logistics management software and information equipments to streamline the operational processes in order to achieve sustainable profits. Moreover, public information platform which was ever only used for e-government affairs has been strengthened especially in seaports and transport fields. Logistics management and e-commerce are included into public information platform

functions. The two representative examples are public information platforms built in Henan Province and Zhejiang Province. “Zhejiang transport and logistics public information sharing platform”, set by the Zhejiang Provincial Transportation Department, has improved the logistics efficiency based on exchange service, integration service, and shared service. The average annual logistics cost savings of Zhejiang Province is estimated about 18 billion CNY. The information sharing platform built in Henan Province has enabled a significant reduction in empty-load freight of trucks of 15% in Anyang City. Moreover, Internet of Things (IoT) has been one of the hottest fields in China since 2009. IoT goes into the governmental work plan as a key strategic industry. It is expected to offer considerable potentials for sensor networks particularly in the logistics field.

Despite the progress of information technology using in major logistics segments and large-scale enterprises, the majority of enterprises remain in the infancy stage characterized by ERP using and web portal. Bar coding, global positioning system (GPS)/geographical information system (GIS), electronic data interchange system (EDI), radio-frequency communication system (RFID) technology are not widely used.

Besides the information technology, it is also an imperative need for the adoption of warehouse management technology, automatic sorting system, temperature controlled storage technologies, etc.

Table 4-9 gives a summarized PEST analysis based on the above analysis. The PEST analysis supports the necessity and applicability of adopting FV projects in China due to the fulfilments of several premises. Firstly, government involvement creates opportunities for an effective governance structure, due to the fact that most successful European FVs are the results of strong public policies. Secondly, economic growth leads to intensification of freight requirements. The present level of freight transport demand is quite adequate for forming a solid foundation for using FVs, as a large amount of freight potential is one of the most important premises for the success of FVs. Thirdly, investments on traffic infrastructure especially on railway probably contribute to the development of FVs, since the intermodality is a key characteristic of FVs. Fourthly, FVs can be derived demands regarding a series of social concerns, e.g. urban distribution problem, agriculture products logistics issue, and inadequate capacity of 3PLs. Besides, much attention to technological development may have a significant impact on FVs operation, which provides a promising base for future growth of FVs.

Table 4-9 PEST analysis summary

PEST	Supports	Challenges
P	Direct support by policies and white papers; Supports from regulatory agencies; “Go West” strategy; Concerns on low-carbon rules; Government supports for retail logistics.	Multiple jurisdictions; Imperfect regulations and a lack of standardization.
E	Fastest-growing economy; Rising domestic consumption; Strong retail sales; Intensified investments in transportation and logistics infrastructure construction; Seaport competition and hinterland connections.	Economic gap between China’s east and west; High share of logistics cost of GDP; Rapid urban population growth.
S	Increasing focuses on sustainability; Knowledge explosion; Customer behaviour change; Improved logistics performance; Advocacy of low-carbon economy.	Complaints about logistics services; Shortage of logistics professionals; Problem of last-mile freight in inner cities; Agricultural logistics conundrum.
T	Information system increase in traffic-related segments and enterprises; IoT appearing; Adoption of advanced logistics technologies in large-scale 3PLs.	Inadequate usage of automation and information technology in logistics activities

4.2 FV development in China and prospects

4.2.1 History review

In comparison to other countries where FVs have been deeply explored over the decades, China shows a more recent but quicker development. Established in 1998, Shenzhen Pinghu FV represents the starting point of the FV practice in China. After that, from 2001 on, the trend of planning and establishing FV projects spread across more regions. In 2003, interest in the concept soared with increased perception of FVs as engines for economic growth. Today establishing FV projects is regarded as a key program for the logistics sector development. In summary, FV development in China has experienced four periods (He, 2009) (see Figure 4-5).

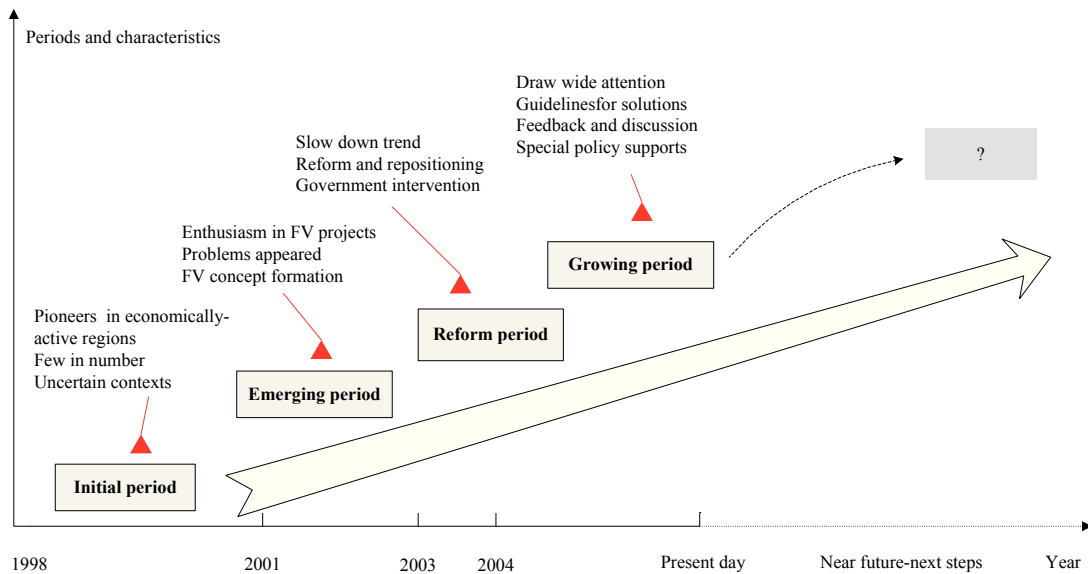


Figure 4-5 History of FV development in China

(1) Initial period (1999-2001)

With the progress of open-door economics, geographic concentrations or clusters of enterprises emerged in 1990s as a result of increasing international trade and global competition. On that occasion, large-scale logistics provision and concentrated supply of logistics services became necessary. To this end, FV projects began to appear in China from the late 1990s on. In 1998, Pinghu FV was established in Shenzhen City, namely the first FV in China. Since then, the FV concept began to be adopted by economically active regions with large demands for logistics services. FVs were few in number and mainly located in the economically active coastal areas, e.g. Pearl River Delta and Yangtze River Delta. In such areas, economies of scale in industry and the ability to accept new things were comparatively higher.

In this initial period, FVs were often understood as industrial parks and technological parks. One distinct feature was that only a few FVs were in operation while most of them were under planning and construction.

(2) Emerging period (2001-2003)

This period was characterized by a fast growing number of FVs coming with several problems. FVs were increasingly accepted especially by 3PLs, local authorities, and property developers. Success stories appeared stimulating more investments in FV projects. Some local authorities and enterprises engaged in planning and constructing FV projects. At that time, FV projects tended to be big size and large-scale investment on the whole. In detail, developers pursued bigger size instead of actual demands. In some cases,

the establishment of FVs was even mistaken as unpractical vanity projects without the support of feasibility studies. The overrated trend brought about high vacancy rate in some FV projects, which resulted in unnecessary land-use and waste of investments. In addition to this, lacking understanding of related theories, unsuitable strategic positioning, and improper planning limited the function efficiency of established FVs.

A large number of FVs were created in a very few years. The overrated trend toward FV constructions climaxed in 2003. Proper guidelines and government intervention became imperative for various issues which surfaced during this period.

(3) Reform period (2003-2004)

The central government and professional associations formulated and executed a variety of reform policies and guidelines, so as to avoid improper construction of FV projects. Some earlier FVs in Shanghai, Shenzhen, and Nanjing started to readjust their strategies.

At that time, bonded FVs appeared. The Shanghai Waigaoqiao Tax-bonded FV was the first to be authorized as an experimental project in 2003. Bonded FVs extend gates of seaports to improve traffic concentration and freight consolidation. The functions of bonded FVs include warehousing of bonded goods, import processing and distribution, assorting, export groupage, etc. Bonded FVs enjoy preferential policies which are available only for bonded areas and export processing zones.

From this period, international and private investments went to FV projects. For example, Global Logistic Properties Ltd has become an important partner in building FVs in China such as GLP Parks in Suzhou, Minhang, Chaongqing, and Chengdu.

(4) Growing period (2004-now)

From 2004 on, FVs have been developed with the intervention of national macro-control policies and in-depth theoretical exploration. Different levels of governments and professional associations have been involved. They launched a series of supportive projects. In 2009, the central government initialized the program of “Logistics Industry Restructuring and Revitalization Planning”. In this program, the FV project was listed as one of nine key projects in the logistics sector. In 2011, the policy paper “Opinions of the General Office of the State Council on the Policies and Measures for Promoting the Sound Development of the Logistics Industry” pointed out that scientific development was vital and the land use for FV projects should be supported. What is more, the specialized committee for FV development was established by the China

Federation of Logistics and Purchasing (CFLP) in 2012.

During the growing period, the efforts in academia and social surveys facilitate and guide FV projects. CFLP and China Society of Logistics (CSL) jointly have held a seminar related to FV topics every year since 2003, so as to provide a platform for worldwide experts to exchange ideas and experiences. Publications such as “Chinese Logistics Park 2009”, “Development Report of Logistics in China 2001-2011” based on these seminars and surveys inspire decision makers, investors and operators of FVs, and logistics researchers, etc.

4.2.2 Examples of China’s FVs

(1) Beijing Airport FV

Beijing Airport FV was approved by the Beijing Government in 2002. Until now, phase-I was finished covering 383 acres and already put into use. More than 100 tenant enterprises cluster there, e.g. TNT Express, Kintetsu Worldwide Express, ProLogis, Zhaijiesong Express, Sinotrans Container Lines, COSCO Group, etc.

It is located in Beijing City which is about 20km away from the city centre. Adjacent to Beijing International Airport, it is connected to Beijing-Chengde highway, two airport expresses, and a national road, etc.

Beijing Airport FV is mainly devoted to seamless airport-highway international cargo transport. It exhibits such major competitive advantages: the only air-road international terminal of Beijing attracting a number of air logistics enterprises by the airport advantage; significantly contributed to the logistics during Beijing Olympic 2008; it is assigned as the logistics experimental base of China by CFLP.

(2) Shanghai Waigaoqiao FV

Shanghai Waigaoqiao FV was approved by the State Council in December 2003, which is China’s first bonded logistics zones and one of the three key FVs in Shanghai. Up to now, Phase-I was finished with 24.7 acres warehouse and 34.6 acres container yard and already put into use. About 26 3PLs and 56 business enterprises are located there, e.g. Newcitycorp, Daiso Industries (Shanghai) Co. Ltd, MOL (China) Co. Ltd, Nippon Express International logistics (Shanghai) Co., Ltd, DHL, Kerry EAS, OOCL Logistics, KWE, and Eternal Asia.

It is located in the forefront of China’s reform and opening up of the Shanghai Pudong New Area. Affiliating to the Waigaoqiao Port Area, it is approximately 3 km

away from the Waigaoqiao Free Trade Zone.

Shanghai Waigaoqiao FV especially contributes to international transit, procurement and distribution, re-exports trade. Its competitive advantages can be: the first pilot bonded FV orienting “hinterland-seaport docking”; based on the maritime transport, it is a comprehensive transport node combining rail, road, and air, which is especially beneficial for the Yangtze Triangle Economic Centre; container throughput reaches up to 1 million TEU per year.

(3) GLP Suzhou FV

GLP Suzhou FV was established in 2000. By June of 2010, it has completed bonded and non-bonded warehouse facilities totalling 109.4 acres. There are 30 3PLs and a great number of manufacture enterprises involved, e.g. Adidas, Samsung, L’oreal, Simens, and Philips. 3PLs tenants include UPS, DHL, FIEGE, IDS, KWE, Sinotrans, DB-Schenker, Amazon, etc.

It is located in the Suzhou Industrial Park, which is a leading hi-tech manufacturing base in China. One hour from Shanghai by expressway, it enjoys a convenient and highly efficient transportation network connecting Shanghai-Hongqiao Airport, Pudong International Airport, Zhangjiagang river port, Changshu river port, Taicang river port, and Shanghai seaports.

GLP Suzhou FV focuses on international distribution, multifunctional warehouse facilities, import-export customs clearance, port functionality, preliminary processing, and packaging. It meets the huge logistics demand from SIP. What is more, the implementation of virtual airport “SVZ” connects air and road transport. “SVZ” was the code of Suzhou Wuxian Guangfu military airport before according to the International Air Transport Association. GLP Suzhou FV uses this code to set up a “virtual airport”, which enables significant time saving for transshipment and customs clearance formalities.

4.2.3 Existing regulatory agencies

Development potentials of the logistics sector and FVs depend on a country’s economic level, public traffic conditions (road, railway, waterway, and air), foreign trade, etc. FV development especially relies on the combined functions of multiple regulatory agencies. The following Figure 4-6 outlines a regulatory agencies structure associated with the logistics sector and FV development in China today. Related departments and organizations are introduced subsequently.

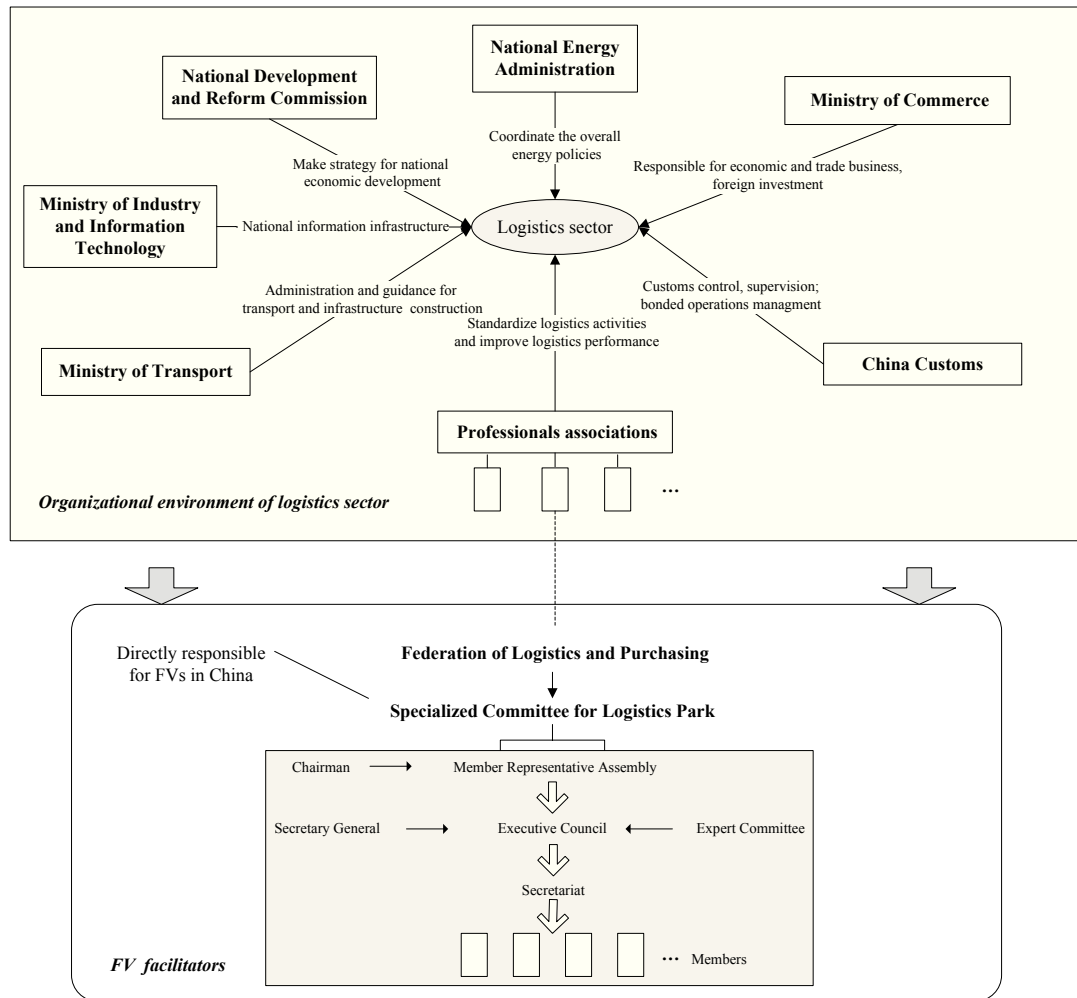


Figure 4-6 Regulatory agencies structure for logistics sector and FVs

National Development and Reform Commission

It formulates and executes strategies of economic and social development, annual plans, medium and long-term development plans. It makes strategy to promote the logistics sector development. For example, a forthcoming draft titled “National FV Development Plan” headed by National Development and Reform Commission will be the first plan for FV development in China. This plan will provide a series of supportive policies for financial, land, water, electricity, transportation, and other ancillary facilities of FVs.

National Energy Administration

It coordinates the overall energy policies. Energy consumption in logistic chains is often big and mainly used in the transportation and warehousing. Hence, efficient energy using becomes a challenge. In line with the promotion of green logistics, issues such as clean and renewable energy source, CO₂ emission reduction are gaining attention.

Ministry of Commerce

It is responsible for economic and trade business, economic cooperation, and overseas investment. Overseas logistics investments can facilitate domestic logistics infrastructure facilities. For example, front runners of China's steel industry like Bao Steel, Anshan Steel, Wuhan Iron, and Steel Corp have cooperated with Mitsui (Japan) to establish a national-wide steel distribution network.

Ministry of Transport

Ministry of Transport is in charge of transportation regulations covering road, railway, air, and waterway. It provides financial support for constructing transport infrastructure as well as making policy and strategy. Intensified investments in transport infrastructure construction in recent years have greatly contributed to the logistics sector.

Ministry of Industry and Information Technology

This ministry concerns the manufacture of electronic information products, communication software industry, and social information services. From order processing to freight delivery, information supports the goods flow ensuring the flexibility, reliability, and time delivery. Logistics information technology enables logistics services such as bar-code, EDI, RFID, and GPS.

China Customs

China Customs supervises and manages all arrivals in and departures from the customs territory. Its affiliated departments such as "Customs Control and Inspection" and "Processing, Logistics Support and Service Bureau" engage in regulating and managing logistics activities relating to bonded warehouse, export, and import. Customs plays a leading role in bonded FVs operations.

Professional associations

Professional associations assist government agencies to standardize logistics activities and improve logistics performance. CFLP is one of the leading professional associations in the logistics field. It is established with approval of central government and administered by the State Economic and Trade Commission (SETC) of China. CFLP play the following functions: organizes annual conference of FVs since 2003; conducts investigation domestic FVs in 2006, 2008, and 2012, subsequently releases reports according to the surveys; cooperates with international logistics associations; shares knowledge of management experience and innovations; assists in creating related standards.

Specialized Committee for Logistics Park (SCLP) of CFLP is newly established, which is directly responsible for FV development specializing in such aspects: serves membership (e.g. FVs, 3PLs); ensures common benefits of logistics industry and the lawful rights for the members; promotes the communication and cooperation among FVs; strengthens self-discipline of the logistics sector and the standardized administration; offers demand information and guidelines for the logistics industry; facilitates the integration between FVs and government departments.

4.2.4 Trends of FV development in China

This research provides an analysis of the findings in China's FVs surveys. Until now CFLP and CSL have jointly carried out three times' surveys in 2006, 2008, and 2012 to examine the FV development. The survey questionnaire includes basic information, constructing situation, operating status, information infrastructure, etc. The survey procedures include (CSL, 2006, 2008, 2012): firstly, collect information about FVs from on-site interviews, reports, and websites, etc; then, make a list of FV projects (in planning, construction, operation) as well as patterns and policies for FV development in different regions; secondly, create a survey questionnaire and conduct surveys; thirdly, collect supplemental information through direct interviews and observation with FVs' managers and tenant enterprises; besides, release the reports of "Development state of China's FVs".

4.2.4.1 Results review and summary

In order to examine the adaptation of FVs to the logistics status, this research offers a comprehensive analysis based on the three surveys' reports of China's FV development (CSL, 2006, 2008, 2012).

(1) Increase in number

According to the 2012 survey, the number of FVs in China reached 754. Among which, 348 FVs were in operation accounting for 46%, 241 FVs projects were under construction which accounting for 32%, and 165 FVs were in planning accounting for 22% (CSL, 2012). In particular, FVs at both operational stage and constructing stage were more. Figure 4-7 shows a growing trend of FVs in number during the past few years.

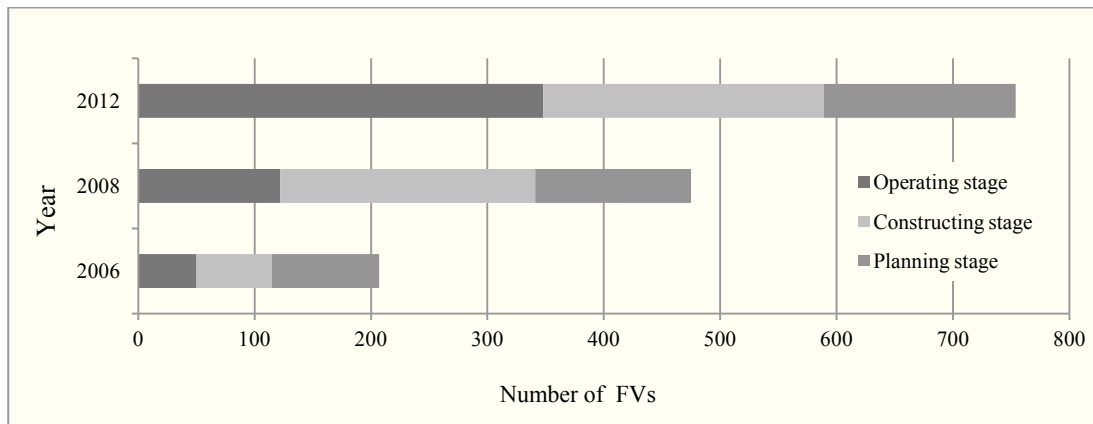


Figure 4-7 Increasing number of FVs in China (2006-2012)

Source: CSL (2006, 2008, 2012).

(2) Geographic distribution

The geographical distributions of FVs are categorized according to the eight economics zones in China (see Figure 4-8). They are Northeast Economic Zone, Northern Coasts Economic Zone, Eastern Coasts Economic Zone, Middle Yangtze River Economic Zone, Southern Coasts Economic Zone, Middle Yellow River Economic Zone, Northwest Economic Zone, and Southwest Economic Zone.



Figure 4-8 Map of eight economic zones in China

Table 4-10 briefly outlines the economic zones relating to their associated provinces and strategic industries.

Table 4-10 Review of eight economic zones in China

Zones names	Associated provinces	Strategic industries
Eastern coasts	Shanghai, Jiangsu, Zhejiang	One of the most competitive manufacturing centers and economic zones
Southern coasts	Hujian, Gungdong, Hainan	Important center of export-oriented economy; Manufacturing center of high-tech products;
Northern coasts	Beijing, Tianjin, Hebei, Shandong	One of the most powerful high-tech R&D and manufacturing center
Northeast	Liaoning, Jilin, Heilongjiang	Heavy equipment manufacturing center; Energy, raw materials, and manufacturing industry
Middle Yellow River	Shannxi, Shanxi, Henan, Neimenggu	Coal mining and subsequent processing, water power, gas energy, fruits, steel industry, non-ferrous metals industry, and dairy
Southwest	Yunan, Guizhou, Sichuan, Chongqing, Guangxi	Chemical and textile industry; Relevant industries chain: tourism planning and development-service industries-tourism products;
Middle Yangtze River	Hubei, Hunan, Jiangxi, Anhui	Agricultural products (rice, cotton, etc); Raw material of steel and non-ferrous metallurgy; Optics Valley Wuhan and automobile production
Northwest	Gansu, Qinghai, Xinjiang, Ningxia, Tibet	Energy center; Important base of cotton, fruits, grain, and livestock products; Special tourism

Figure 4-9 describes the geographic distribution of FVs based on the three surveys. Regarding this chart, several trends and characteristics of FVs geographical distributions in China are indicated. First, FVs increasingly appeared in the northwest China, but before there were few there regarding the 2006 survey. FVs create new links out of western China to drive potential development opportunities. This would bridge the economic gap between the West and East. Second, there seems a decrease in coastal regions. As mentioned previously, the economy of eastern and southern coastal areas are relatively developed and FVs emerged there earlier. Today this phenomenon probably results in the optimization of logistics resource and strategic adjustments of FVs in such areas. Third, FV projects grew fast in the regions along Middle Yellow River and Middle Yangtze River. Owing to the program of major logistics channels planning, logistics resources are extending into inland areas. Moreover, some cities with crucial geographic positions are located there, e.g. Wuhan (in Hubei Province), Xi'an (in Shannxi Province), and Zhengzhou (in Henan Province).

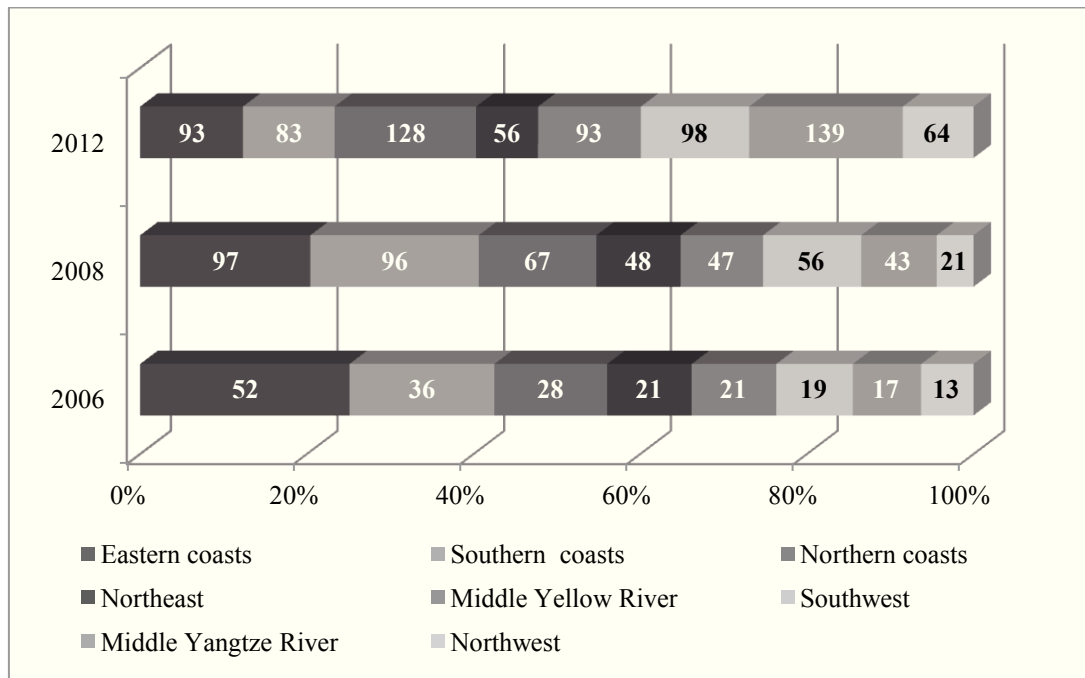


Figure 4-9 FVs geographical distribution in China (2006-2012)

Source: CSL (2006, 2008, 2012).

(3) Establishment patterns

Figure 4-10 shows that the establishment patterns of FVs in China mainly include three types: “governments’ planning + tenants’ construction”, “governments’ planning + property developers’ construction” and “enterprises’ planning & construction”.

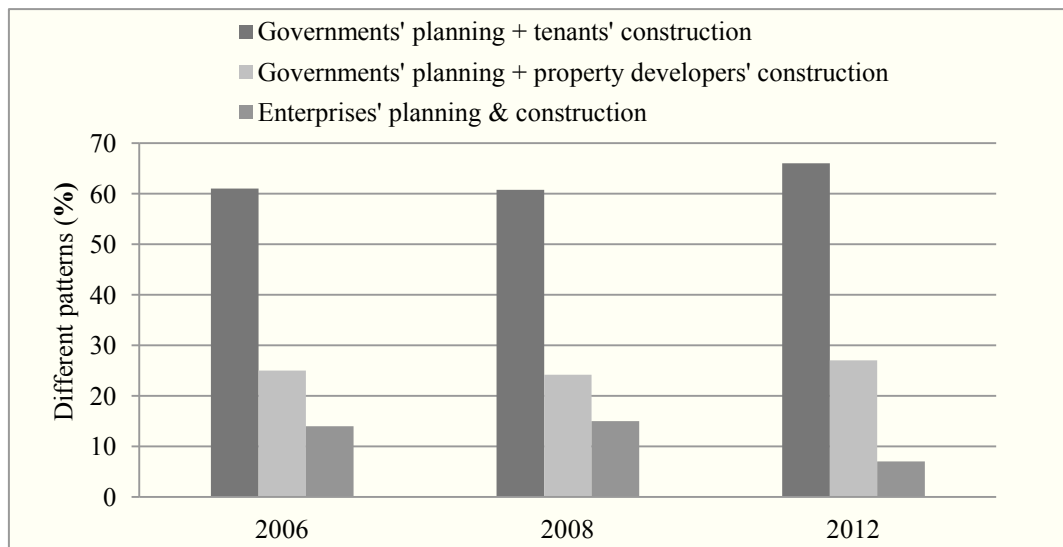


Figure 4-10 FVs developed by different patterns (2006-2012)

Source: CSL (2006, 2008, 2012).

The pattern of “governments planning + tenants construction” plays a leading role which conforms to the mainstream of worldwide FV development. Interventions of public

sectors in the initial stage are also universal in other countries. Governmental support is considered as a crucial element for FVs success. The supports cover land use planning, public infrastructure configuration, attraction for tenants and financial sponsors.

(4) Profit sources

Table 4-11 lists the profit sources of existing FVs and the situation remained nearly unchanged over the past several years. Warehouse rental is the primary profit source. Most profit sources are related with rentals of various facilities. Profiting largely relying on rentals seems unable to sustain competitive advantages of FVs. Profit sources should take more considerations toward e-commerce services, information platform provision, and value-added services.

Table 4-11 Profit sources of FVs with different importance

Importance	2012/2008/2006
★★★	- Warehouses rental
★★	- Office buildings rental - 3PLs services - Value-added services - Auxiliary facilities rental - Property management revenue
★	- Subsidize revenue from the country - Tax break - Appreciated value in real estate

(5) Barriers

The current barriers to FV development in China are identified:

- 1) Deeper insights of FVs theories are still in need;
- 2) Some FV projects cannot meet the need of regional development: (i) mismatch between FVs and levels of regional economy, (ii) inefficient links to external traffic, and (iii) inadequate coordination with industrial demands and city/town planning;
- 3) Difficulties in land acquisition at the start-up stage;
- 4) Shortage of skilled manpower in the logistics field;
- 5) Policy supports are still needed.

Regarding these barriers, the 3rd survey report suggested that a manageable coordination mechanism at different levels is imperative. It pointed out that the central government should outline an overall scheme of nation-wide FV projects. In line with the country-level scheme, local authorities propose adapted development approaches. In addition, integrating traffic facilities into FVs should be further strengthened. Barriers

facing China's FVs over the past few years are identified and ranked in Table 4-12.

Table 4-12 Identification and ranking of barriers to China's FV development

Barriers	2006	2008	2012
Difficulties in land acquisition	1	1	1
Inadequate planning work	1	1	3
Lacking preferential policies	2	2	2
Difficulties in approval	2	2	3
Lagging facilities	2	2	4
Shortage of funds	3	1	4
Unclear strategic positioning	4	2	5
Mixed logistics activities	4	3	8
Inconvenient clearance	5	3	9
Insufficient functionality	6	3	6
Low management level	7	3	7
Inappropriate locations	7	3	8
Others	4	3	-
Local economic status limitation	-	-	3
City planning limitation	-	-	5
Public traffic limitation	-	-	7

4.2.4.2 Fishbone diagram - finding the causes of barriers

This research uses the method of "failure-cause" diagram also called fishbone diagram to explore the causes of the above barriers. It is a critical component of problem solving training delivered as part of the induction into the Toyota Production System (Colin, et al., 2011).

The fishbone diagram is an effective problem-solving tool to be used by groups of people involved in finding possible causes of the problems. The causes can be split into several categories. Each of these categories is then examined in more detail and other potential causes are considered. Figure 4-11 depicts possible causes for the barriers to FV development in China. The causes fall into six categories according to the facts: initial prerequisites, strategic positioning, operational capability, regional synergistic effect, management structure, and green logistics.

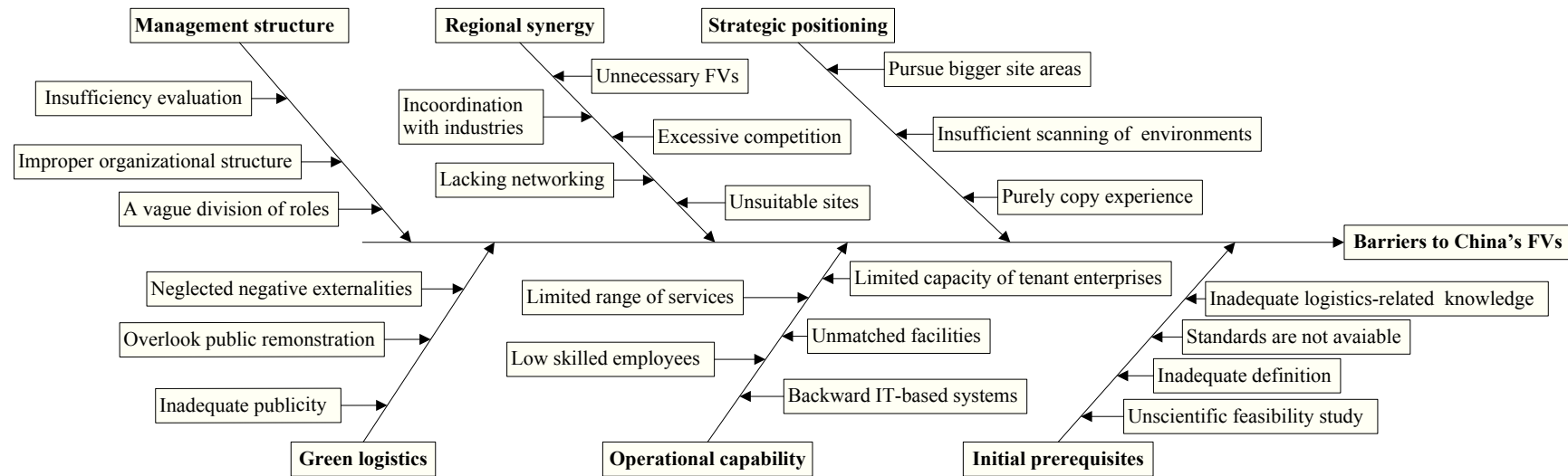


Figure 4-11 Fishbone diagram for finding the causes of barriers to China's FV development

4.2.5 SWOT analysis for finding future directions

SWOT means strengths, weaknesses, opportunities and threats, which stands for:

- Strengths (what are the positive attributes of the company/organization, product or service?)
- Weaknesses (what are the negative attributes of the company/organization, product or service?)
- Opportunities (where are the market opportunities for the product/service provided?)
- Threats (what are the main threats to the company/organization?)

SWOT analysis is a well-liked type of business method for examining a business model through a simple lens. It may give a clear picture about future directions of this business model. If it is used properly, SWOT analysis will provide a strong basis for strategy formulation. It can offer insights to the ways of converting the threats into opportunities, and offsetting the weaknesses against the strengths (Mainali, et al., 2011). Hence, SWOT analysis can be regarded as a precursor to strategic management planning (Arslan & Er, 2008).

Table 4-13 summarizes the major strengths and weaknesses, opportunities and threats of FVs in China based on the above PEST analysis and the status of FV development, so as to assist in formulating strategic orientations for the further development.

Table 4-13 SWOT matrix of China's FV development

SWOT matrix	
Strength Gradually extend to hinterland areas; Establishment of specialized committee for FVs; Wide acceptance of logistics way of FV; Regarded as a key project nowadays; Success stories of some existing FVs.	Weakness Difficulties in land acquisition; Inadequate planning work; Difficulties in approval of FV projects; Limited capabilities of facilities; Shortage of funds; Vagueness in strategic positioning.
Opportunity Governments attach much importance to FVs; Growth of China's economy; Public logistics network is forming; A growing trend of low-carbon economy; "Go west" strategy; Demand of specialized logistics services; Relocation of old-fashion warehouses. Leading role in inland ports.	Threats High requirements on logistics services; Underdeveloped 3PLs market; Shortage of logistics practitioners and talents; Land shortages and high cost of land; Pressure from carbon tax in international trade.

On the basis of the key points of SWOT analysis, the following possible strategies for further development of FVs in the context of China's logistics status are proposed:

- S/O strategy

Establish specialized FVs considering industrial characteristics;

Structure regional integrated logistics networking;

Regulations on below standard FV projects

- W/O strategy

Make plan in line with the actual demand;

Much attention on social functions, e.g. urban logistics, agriculture products logistics;

Sustainability consideration embedded in operations

- S/T strategy

Land-use planning control;

Facilitate cooperation among stakeholders;

Strengthen social training and school education

- W/T strategy

Extend industrial chains for attracting more tenants to reduce business risk;

Enable knowledge spillover and learning effects within FVs;

Apply innovation technology

In order to break the current barriers, this research identifies the following four directions to strengthen FVs' adaption to China's logistics situation:

- (1) Make use of inherent double nature especially the orientation of sustainability;
- (2) Create the precondition for the success by well-organized planning work;
- (3) Consider knowledge-based approaches, e.g. logistics-related education, information management, knowledge sharing;
- (4) Explore the applicability of FVs in more freight-related fields for the sustainability benefits.

4.3 Summary

This chapter comprises two distinct sections. The first section explores the macro-environment relating to the logistics situation in China and examines the adaption of FVs to such a situation by PEST analysis. This macro-environment exhibits several characteristics such as growing logistics market, insufficient logistics efficiency, rising logistics outsourcing. A PEST analysis indicates that FV projects are applicable and quite necessary.

The second section aims to discover the directions for next steps of FV development

through SWOT analysis based on the survey results of China's FV development and some successful examples. A review of FV development history and the existing regulatory agencies for the logistics sector and FVs are exposed. It analyses the findings from China's FVs surveys and reports. A series of barriers to FV development are identified, and the causes for these barriers are explored by a fishbone diagram. The SWOT analysis highlights several directions for next steps of FV development. Accordingly, the forthcoming chapters in this dissertation will focus on such directions.

CHAPTER 5

Integration of knowledge management approach to the planning stage of freight villages

Inadequate FV project definition and planning is a universal phenomenon in China. Well-organized planning work with solid experiences is crucial for realizing sustainability-oriented values of FVs. Only with this can it avoid negative consequences from the outset, e.g. unnecessary FV projects, high vacancy rate, improper site selection, disturbance to local residents, air and water pollutions.

The FV planning stage depends largely on the identification, interpretation, creation, and use of related knowledge. KM is a planned and structured approach of systematically and actively managing knowledge for achieving the expected outcomes. Thus, in this research, FV planning adopts KM approach for the sustainability-oriented consequences.

This chapter begins with two existing examples of FV planning approaches. Then it proposes a frame diagram of FV planning steps toward sustainable development. After that, “sense-making KM model” is used to guide the FV planning process consisting of sense making, knowledge creation, and decision making.

5.1 Examples of planning approaches

In recent years there have been significant developments in FV planning stage in terms of location selection, scale and size planning, and investment scheme. So far in the literature, however, there are few thorough planning process and guidelines for FV projects. The following two examples provide a set of steps relating to the FV planning process.

5.1.1 MSFLB planning approach

Fang (2005) proposes a so-called MSFLB approach as a tool for the FV planning stage based on the practical experience and theoretical background. This approach describes a routine including five steps: market study, strategic positioning, functional design, layout design, and business plan (Ye & Tiong, 2000) (see Figure 5-1).

Market study process scans the environment involving economic situation of adjacent areas, public infrastructure, services, and business competition for the strategic development. It is an intensive information-based step including accumulation and analysis of bulk secondary information as well as primary information. The primary

information is usually acquired through depth interview, telephone interview, and questionnaire. All the data and information will be distilled and translated into useful information and knowledge by structure conduct, performance paradigm, and requirement estimation approach analysis.

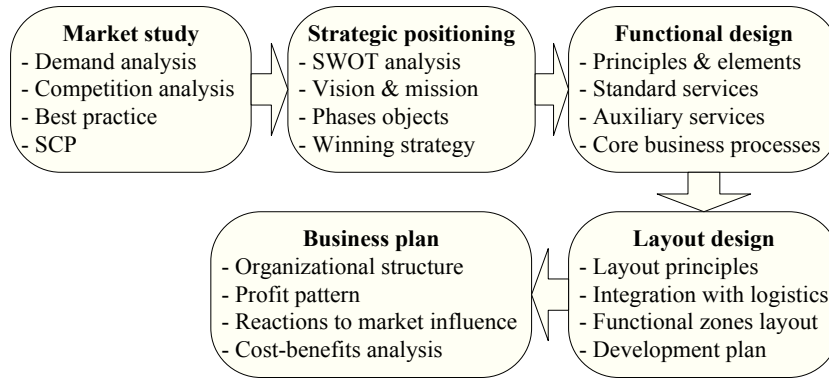


Figure 5-1 MSFLB approach to FV planning

Source: Fang (2005).

Strategic positioning is generated in line with the market study. SWOT analysis is particularly recommended as a tool to assist decision-makers in identifying internal and external status quo as well as developing strategies. Thus, the vision and mission, phase objects, and winning strategy of the proposed FV project can be formulated properly.

Functional design of FVs is suggested to adopt the top-down method considering the planning principles. Knowing of the standard and auxiliary services as well as successful experiences of existing FVs is necessary. Then an appropriate scheme of functional design is determined taking into account the market study and strategic positioning. Specific elements such as size, facilities, technical system are planned based on the functional design. Finally, core business processes of the proposed FV project should be defined, e.g. container service, raw materials supply, and bonded logistics process.

Based on the previous three steps, the layout is designed considering the whole journey (e.g. receiving, processing, storing, and dispatch) of handing goods within FVs. A suitable layout ensures effective cooperation among tenants, facilities, and goods, so as to gain the maximum profits. Several design patterns are proposed: traditional campus pattern of functional zones; intermodal node pattern; airport-based, seaport-based, and road-based patterns; ecological landscape-based pattern.

The last step is the business plan including the FV management structure and responsibilities identification, marketing strategy, analysis of potential tenants, and cost-benefit analysis. It can be the preparation for the further plan implementation. It is

worth noting that a FV project is usually time-phased, since this is good for cost control and risk avoidance.

5.1.2 Practice experience

As a major partner of DGG since 1998, the Institute of Shipping Economic and Logistics (ISL) in Germany has been committed to national and international FV projects. Based on ISL's long-time project experiences, the initial phase of a FV project is generally outlined as an overall framework involving basic conditions examining and feasibility considerations. In more detail, activities in the initial phase mostly include contacting related persons, collecting records and documents, and analyzing potential locations (e.g. costs and legal ownership structure).

It is pointed out that the feasibility study of a FV project basically comprises the market analysis and master plan. The market analysis is firstly undertaken by considering a number of influential factors such as transport and logistics structures of the area/region, logistics processes and their prognoses, as well as the logistics requirements from perspectives of both shippers and 3PLs. Then master planning comes after the market analysis which contains the structural planning, the way of functioning, infrastructure, etc. The information about costs and effects in the aspect of traffic are particularly acquired. In response to the sustainability trend, the assessment of environmental impacts is involved in the master planning.

Based on the practice experience, ISL proposed a structure of FV planning process including traffic/logistics analysis, location analysis, master plan, and proposals (see Figure 5-2). It offers a guideline for the planning work of FV projects on the whole. Furthermore, the FV location study is detailed as Figure 5-3, covering five aspects: free areas, periphery, centrality, quality of transport connection, and planning security.

Regarding the structure of FV planning process, the planning phase requires all-sided information and knowledge knowing. Besides the initial planning, when it comes to the plan implementation, a conversion phase following planning but before the implementation phase is emphasized. This phase focuses on two tasks including the financing scheme for the sponsorship and marketing of the FV. The former task results in suggestions for the foundation of a FV sponsorship and a draft of financing plan. The latter task enables the acquisition of tenants by the exposure of potentials and advantages of the proposed FV project.

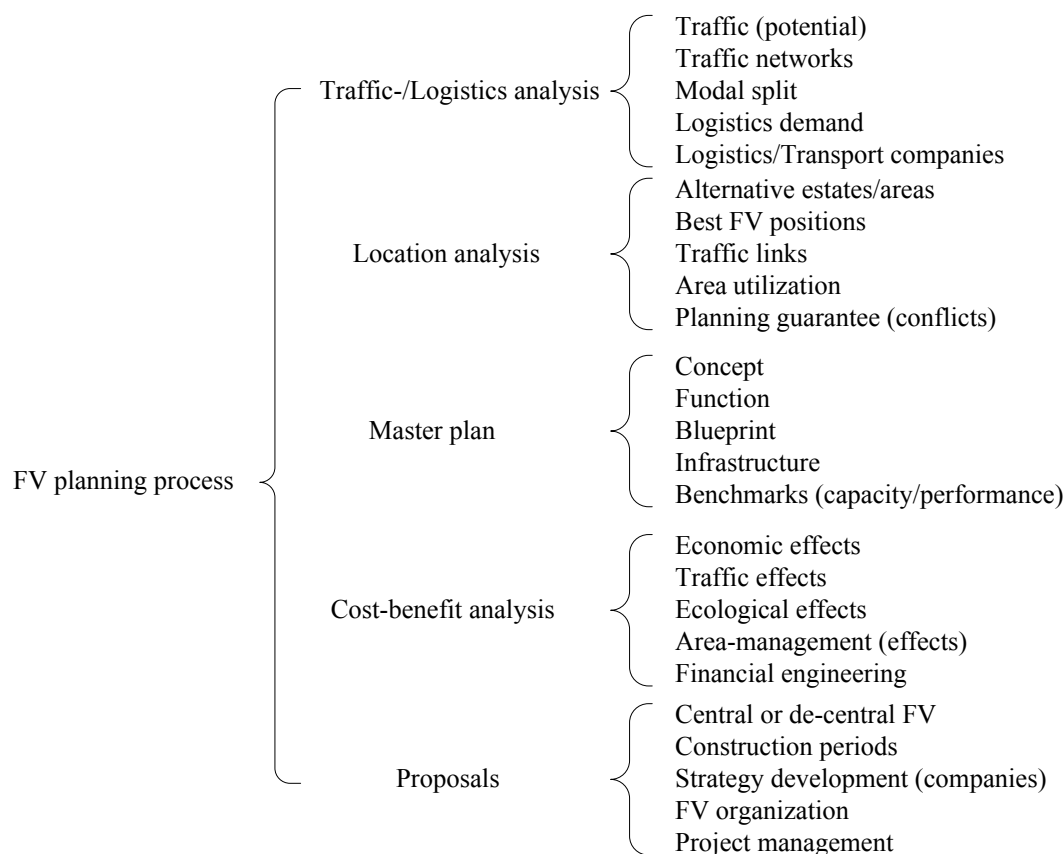


Figure 5-2 A structure of FV planning process

Source: ISL (2010).

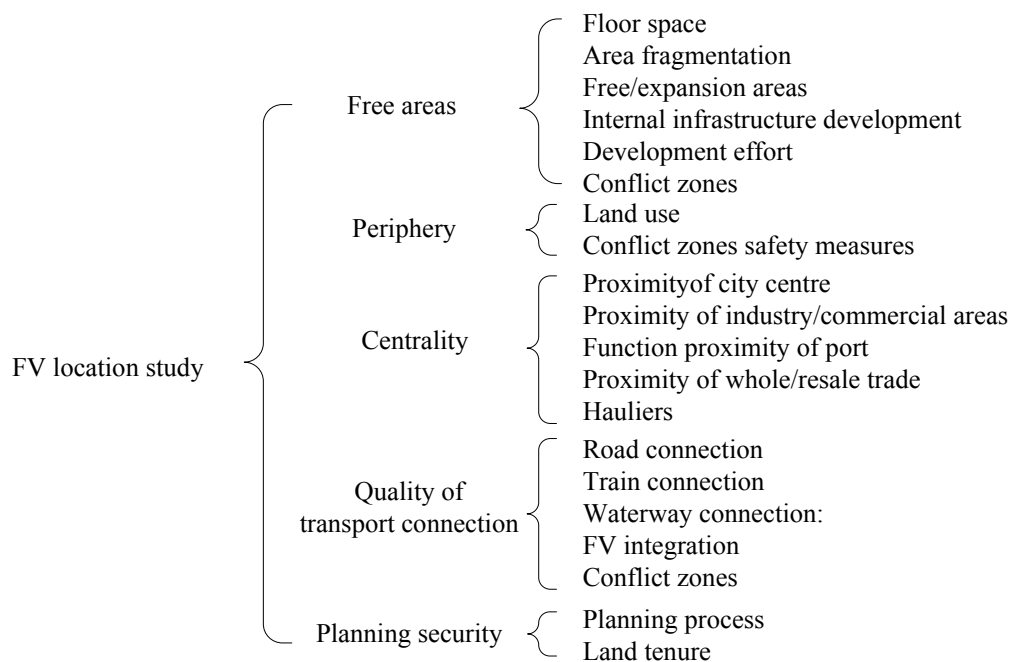


Figure 5-3 FV location study

Source: ISL (2010).

5.2 Planning steps

The realization of a FV project is similar to a risky venture, since it is too large and complex, and especially due to the bigger investment but longer payback period comparing to other general business activities. Thus, the planning stage is essential for the success of these ventures in despite of different ownerships or management structures. Facts have indicated that adequate planning work can probably avoid “wrong journeys” in actual operations of FVs. For instance, GVZ Bremen project spent millions of dollars and more than 10 years in research and development before breaking ground. The Rungis facility began as a private investment effort that failed before it achieved success with a redirected plan and new capital (Weisbrod, et al., 2002).

FVs face the sustainability-oriented challenge. Well-prepared planning plays a key role in avoiding negative phenomena in actual operations, e.g. unnecessary FV projects, high vacancy rates, inappropriate locations, over-sizing, unsatisfactory layout of functional zones, limited or impossible expansion. Such mismanagement will not only waste resources, but also affect other organizations’ social and economic activities. Moreover, a well-considered plan is crucial for encouraging synergies and networks by locating activities in FVs towards sustainability. In detail, such a plan helps FVs to coordinate with regional or national traffic network, improve the disparity of logistics benefits between different regions, as well as react rapidly to emergencies such as natural calamities.

To make a sustainability-oriented plan effectively, the quality and structure of the planner team is a key factor. The planner team designs, dimensions, and optimizes the FV project. Taking into account multiple contributing factors to the FVs’ sustainability, the planners should cover multidisciplinary experts, including logisticians, traffic planners, computer specialists, architects, engineers, economists, environmental specialist, and local residents.

Figure 5-4 depicts a framework for accomplishing the plan of FV projects oriented sustainable development. This planning route comprises four steps: first is the target planning, then is the system planning, after that is the detail planning, and the final step is tendering planning (Gudehus & Kotzab, 2009).

Target planning is also called demand planning, goal planning, pre-planning or basic planning (Gudehus & Kotzab, 2009). Only motivated by actual demands from the logistics industry or the society, the proposed FV project will bring about

sustainability-oriented values. Information collection and analysis enable planners to make sense of dynamics in the regional development as well as perceive the logistics trend, thereby generating the overall strategic positioning. It is worth noting that information and knowledge should be acquired from multiple sectors related to FV construction, e.g. clients, designers, consultants, contractors and inspectors. Inter- and intra-discipline communications are often necessary. The result of the target planning is a documentation clarifying the goals and objectives of FV projects, and relevant prerequisites required for planning steps (Gudehus & Kotzab, 2009). The documentation is called demand record book, which will be presented to the local authorities to approve the preliminary proposal of a FV project.

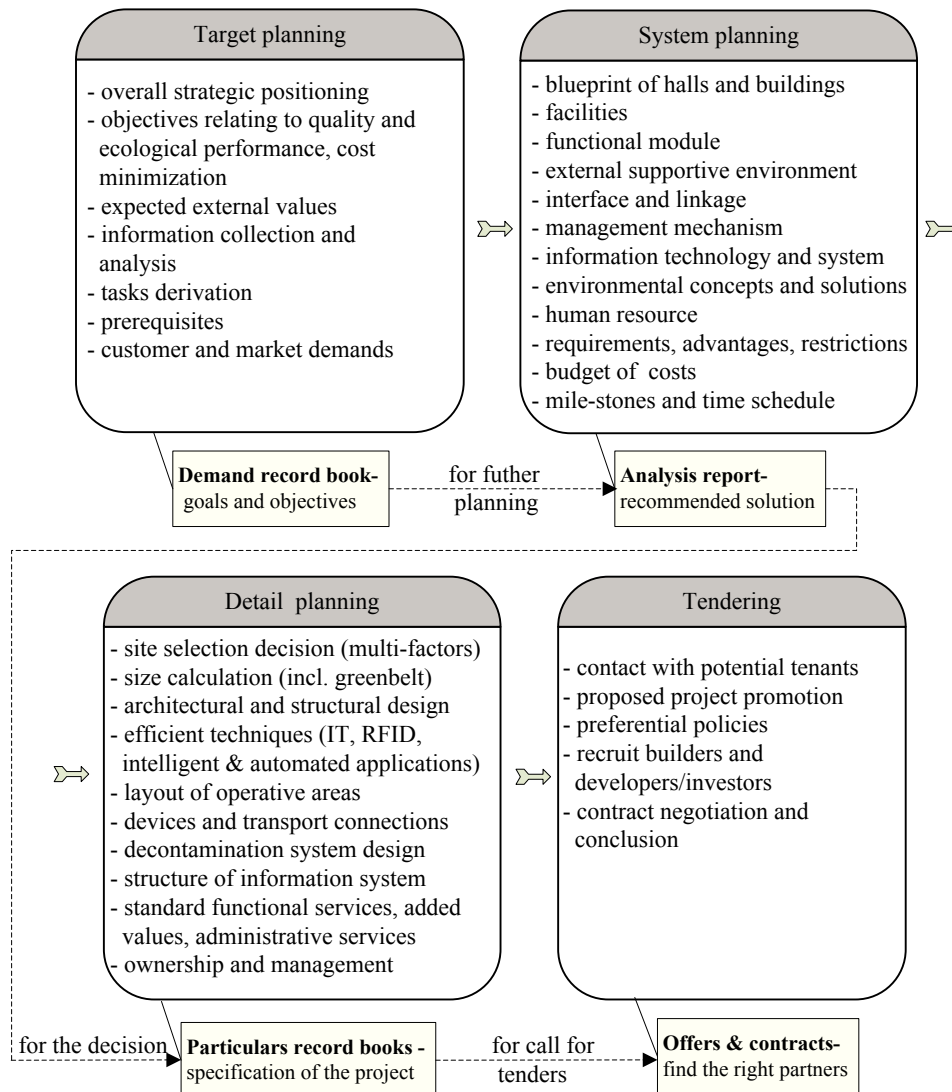


Figure 5-4 Framework of FV planning steps

System planning here concerns the integrated analysis and design of a FV project and its components, as well as the interpretation of external supportive environments,

requirements, advantages, and restrictions. The work of system planning involves appropriate logistics services, the budget of investments and operating costs, mile-stones and time schedule. System planning creates an analysis report where the suggested solutions are offered. The analysis report describes a blueprint of the proposed FV concerning designs of functional systems (infrastructure, facilities, traffic network, human resource, etc.); concepts of environmental protection and low-energy technology using; function descriptions of different installations and devices and their possible impacts on the sustainability. This step can decide whether the FV project should be realized or not.

When the FV project is accepted, a detailed planning is required in order to work out a more precise solution and get the approval from authorities (Gudehus & Kotzab, 2009). The detailed planning of FV projects oriented sustainability covers site selection, size calculation, design, services definition, layout of operative zones, ownership, and management. Site selection is of paramount importance in FV operations. A FV project's success depends on a proper site selection to a large extent. Site selection is based on a multi-factors evaluation model considering certain objectives and general principles, e.g. intermodal connection, economic adaption, the balance with ecology environment, and operators' financial profits. Size calculation should take into account the available service scope, demand forecasts, haulage distances and costs, land-use price and limitations, logistics disposal amounts, regional GDP, accessibility, congestion degree, timeliness requirements, and the greenbelt area. The planning outlines the preliminary infrastructure of the FV project involving the aspects such as rational design of buildings, information system and decontamination system, efficient technical devices, transport means. The core competency of FVs depends much on the services can be provided, which should be identified and determined responding to regional demands and freight capability. The services include three categories: standard services include shipping and receiving, storage, order picking, break-bulk, freight consolidation and containerization; value-added services relate to total logistics management, inventory control and tracking, packaging, labelling and bar coding, procurement and vendor management, and customer service functions, such as returns, repair, rework and assortment promotional assembly; administrative services involve customs clearance, invoicing, order scheduling, data processing, etc. Layout of operative zones is defined based on the available service scope. It mainly concerns the categories of operative areas, individual functions of each area, and a systematic layout ensuring the holistic efficiency. Usually, at the planning stage, it is not possible to cover all potential operational zones because of the limited funds and

lands. Hence, the “sequence analysis” method and “phased construction” way may help reducing risks in such adventures. What is more, the ownership is related to the financing plans (investors and sources of investment) and the management model refers to the management structure and roles identification. The alternative funding schemes can be different combinations from three funding sources: private investors (equity), bank loans, and public subsidies (actually free money for the private investor) (D. A. Tsamboulas & Kapros, 2003). Two major management models are government-dominated and enterprises-dominated. The selected management model will promisingly realize the FV functions if it fits the funding scheme and actual situations.

Tendering planning provides the grounding for finding the right partners to undertake the construction. At the beginning, it is necessary to increase the attraction of the proposed FV project to acquire investors, thereby ensuring the construction goes smoothly. A broad marketing spread of the FV could be raised through widely generating publicity of the proposed program, contacting with potential tenants (3PLs, manufacturing enterprise, trading companies), and introducing preferential policies. Besides, objective assessment of the developers and investors is crucial to find more suitable partners. There are two necessities with regard to the object assessment: proper identification of tenders’ scale; choose adaptive evaluation methods for each type of tenders. After the planning stage, FV projects are executed in the realization stage (tendering, construction, acceptance, acquisition of potential settled enterprises, put into use, etc).

5.3 Knowledge management approach

The planning steps mentioned above involve a series of knowledge-related activities including information acquisition and sense making, solutions creation and decision making. Thus, coherent connections among the four planning phases rely on the knowledge-centric advantages. Consequently, incorporating a KM approach to the FVs planning stage is possible to minimize mismanagement consequences from the outset.

While there are numerous KM theories which may be associated with FV projects planning, few clearly consider the interactive processes with the involvement of perceiving the environments and demands, collecting and creating knowledge for the plan and making decisions. A managerial strategy approach named “sense-making KM model” can optimize the FV planning steps toward the sustainable development objective.

Choo (1998) asserts that “knowing organizations” are those that use information strategically in the context of three arenas, namely, (i) sense making, (ii) knowledge

creation, and (iii) decision making (see Figure 5-5). Strategically utilizing knowledge coherently in these aspects forms the “sense-making KM model”. Sense making means that the organizational administrators identify dynamics in external environments through scanning and translating related information, thereby exploring the emergence of a new strategy. Knowledge creation refers to the new knowledge created by organizational operators or managers based on knowledge transforming. Decision making relies on the processing of acquired knowledge and created knowledge (Dalkir, 2005).

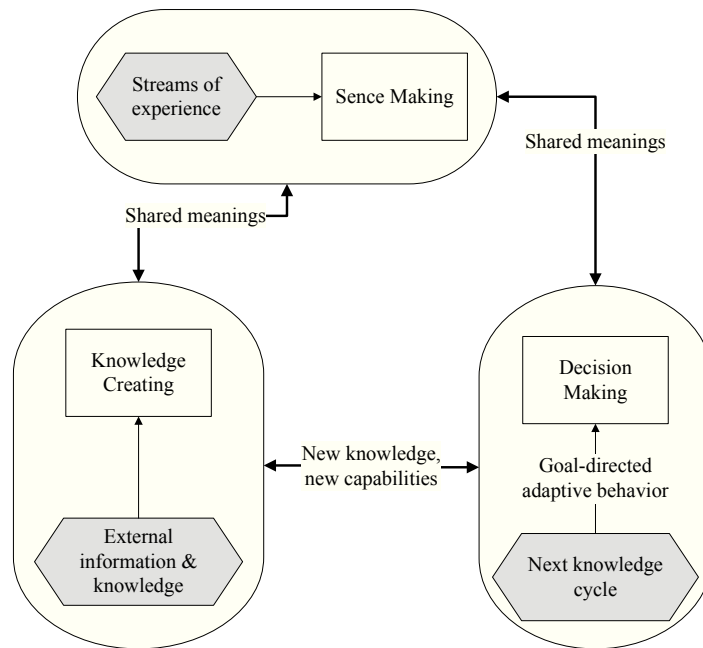


Figure 5-5 Overview of Choo's (1998) “sense-making KM model”

Source: Dalkir (2005).

Planners use information strategically in three areas: to make sense of changes in the environments including dynamics in the logistics industry and the social needs for FVs; to create knowledge for evaluating the necessity and feasibility of FV projects; to make decisions constituting the detailed planning based on the available solutions.

5.3.1 Making sense of requirements

Sense making can reduce ambiguity in messages embedded in external environments before a FV project planning. It develops the shared meaning among planners for collective and purposeful actions taking place in the decision making process. An inadequate sense-making process leads to poorly understood objectives, missions, and visions. This in turn can lead to ill-considered plans and consequently inadvisable decisions (Weick, 1995). Effective knowledge acquisition of external sources depends on

the ability of the organization to identify the value of external information and new trends, as well as assimilate and apply them into commercial ends (Massa & Testa, 2009).

Sense making ensures the adaption and prosperity in a dynamic and complex environment. Figure 5-6 describes a sense-making process in the initial period of FV planning stage, which consists of six phases: identify situations, explore relevant cues, cluster information, comb meanings, interpret related information to goals, and connect understanding to actions.

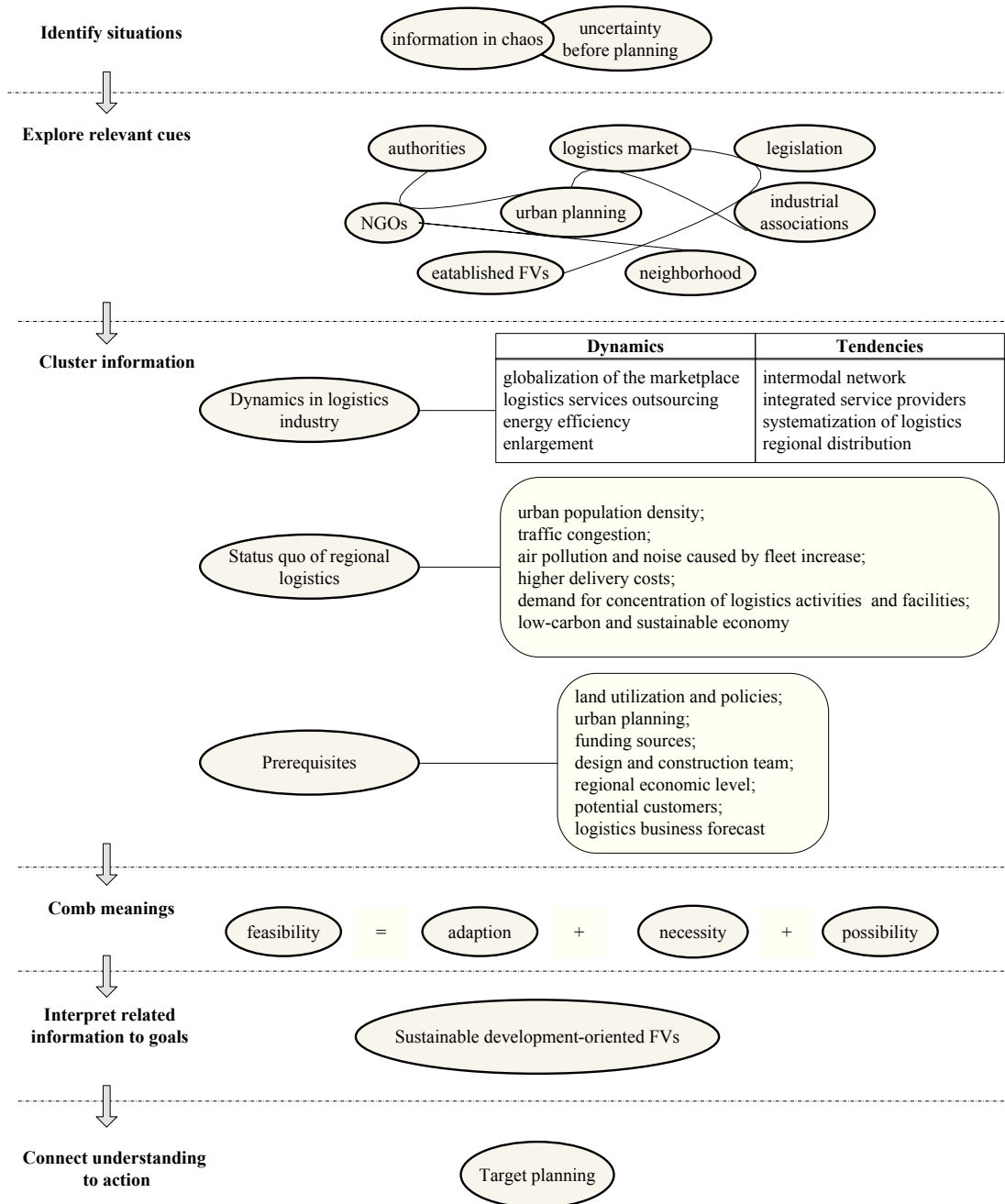


Figure 5-6 Sense-making for FV target planning

Identifying situations of “information in chaos”, “uncertainty before planning” is depicted at the start. In the face of the rapid expansion of new concepts in a variety of fields, the ability of examining the adaption and adoption of new things becomes core competitiveness. However, since FVs in best practices bring about considerable benefits, some developers are lost in the legend about FV’s magic effects. They engage in FV projects construction without more considerations about the uncertainty situations at the beginning, consequently these projects probably go to failure. In actual practice, first of all, the developers should assess the necessity of the proposed project. This requires them to make clear the prerequisites and the adaptive conditions of FV projects in an uncertain situation. FVs’ successful practices are not encouraged to be purely copied, thus the planners should scan the facts embedded in the information chaos and uncertainties before ground breaking. This phase primarily provides a protective screen for better avoidance of unnecessary FV projects.

Relevant cues exploration is then followed to break through the information chaos leading a shift to knowledge identification. FVs are characterized by twofold functions, accordingly, multiple of external parties and sectors are involved. The knowledge cues extend beyond organizational boundaries concerning governments’ attitudes, dynamics in logistics market, urban planning, industrial best practices, competitiveness of existing FVs, ecology-related requirements from NGOs and the “natural neighbourhood”. In reality, interactions of these cues constitute a stakeholders’ network in support of FV operations. In summary, this phase harmonizes the interests of multiple groups of stakeholders and involves the sustainability criteria in the planning process.

Information cues are then structured through information clustering. Three categories of information are needed: dynamics in logistics, status quo of regional logistics, and prerequisites of a FV project. They constitute a set of guidelines for basically evaluating the value of proposed FV project. Firstly, it starts with perceiving dynamics in the logistics industry and their corresponding tendencies. This can facilitate adjusting strategic position of a FV in current logistics field. Secondly, the information cluster of “status quo of regional logistics” provides a range of considerations in planning. High delivery cost calls for consolidated logistics activities and facilities, which implies the irreplaceable position of FVs in regional development. Meanwhile, the growing urban population and traffic congestion are unavoidable during city expansion. Negative impacts on the ecological environment and local residents do surface, e.g. air pollution and noise caused by fleet increase, increased traffic accidents. Furthermore, the

low-carbon and sustainable economy require logistics operations to take social responsibility into account. Thirdly, knowing the prerequisites for FV projects is essential. Generally these prerequisites cover land utilization and policies, urban planning, funding sources, design and construction team, regional economic level, potential customers, and logistics business forecast.

In the initial stage of FV planning, the objective of sense making is searching for meanings embedded in the situations' identification and information cluster. Adaption, necessity and possibility are essential components to verify the feasibility of a FV project. (i) "Adaption": the proposed FV project complies with the worldwide and national logistics development tendency, thus their activities are possible to extend to more broad regions. (ii) In order to avoid unnecessary FV projects, "necessity" comes from the expectations of the current situation improvement and accumulative effects brought by clustered logistics facilitates and services. (iii) "Possibility": potential supports in terms of physical conditions, human resources, financial sources, market potentials, and policy support, etc. Any of the three components can be an obstacle to a FV project, and may result in failure in actual operations.

The sense making process not only sets the goal with interpretation of related information, but also examines the feasibility of FV projects. Investigating the feasibility orientating a specific goal, this process can be viewed as a target planning process.

5.3.2 Creation of knowledge

Since the planner team is usually established temporarily for a proposed FV project, the organizational knowledge retention rarely exists. Any FV project design can be deemed as a knowledge creation process, which is the development of new ideas through interactions between explicit and tacit knowledge in individual human minds. Knowledge creation process enables organizations to amplify knowledge embedded internally and transfer knowledge into operational activities to improve efficiency and create values (Nonaka & Konno, 1998; Nonaka, et al., 2000).

Figure 5-7 depicts the application of SECI model in creating knowledge used for a FV project plan. The SECI process of knowledge creation describes the interactions between tacit and explicit knowledge. Importantly the concept of "ba" is regarded as a medium to enhance knowledge sharing to drive knowledge creation. Normally "ba" can be thought of as a shared space for emerging relationships. "Ba" in this research provides a platform for the resource concentration of the planner team's knowledge assets and the

intellectual capital yielded in the FV planning process. FV planning toward sustainable development should be processed in such a “ba” which is founded by related people and experts in a multiple sectors environment. They may be governments, residents, related companies, other FVs, land owners, research institutes and universities, etc. The FV planner team undertakes the planning work through interacting with these sectors.

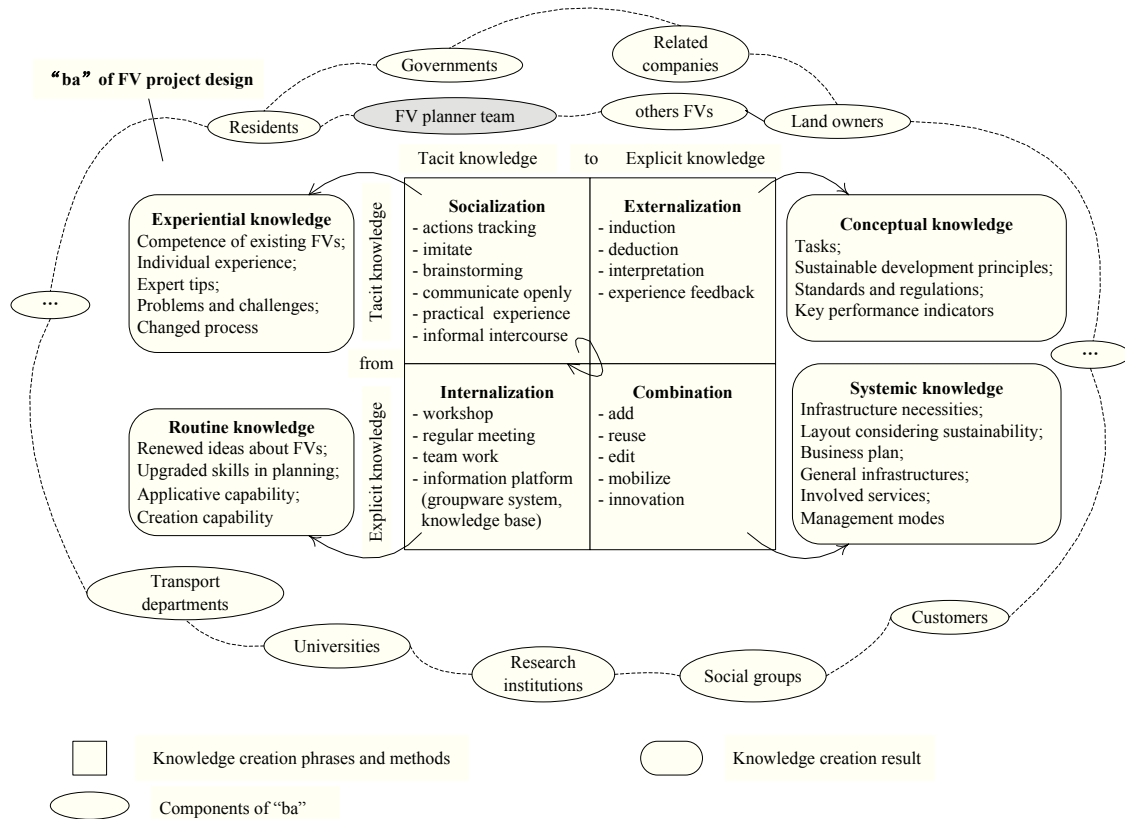


Figure 5-7 Application of SECI model in knowledge creation for FV projects

Nonaka & Takeuchi (1995) propose a model of the knowledge creating including four successive processes: socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit), and internalization (explicit to tacit). After internalization the process continues at a new “level”, hence the metaphor of a “spiral” of knowledge creation often referred to as the SECI model (Nonaka & Takeuchi, 1995). Four categories of knowledge assets are created by means of various interactions within the “ba”, namely “experiential knowledge”, “conceptual knowledge”, “systemic knowledge”, and “routine knowledge” (Nonaka, et al., 2001).

(1) Socialization process

The FV planner team accumulates and shares tacit knowledge in the “ba”. Through knowledge socialization, it is possible to access most types of knowledge which are

essential for the FV project planning. Due to the uniqueness of any FV project and the temporality of its planner team, the socialization process provides adjustments among team members. Tacit knowledge in this process comprises the understanding of competence of existing FVs, individual experience, and expert tips for planning FV projects; sensing problems and challenges related to requirements and restrictions; awareness of changing FV planning process in different situations. Team members usually share and create such tacit knowledge through direct experiences. For example, FV planners can accumulate such tacit knowledge by practical experiences in certain FVs through the observation of other FVs' behaviours, thus improve their insights from the theoretical level to the practical level. At the same time, they can imitate best practices. Therefore, when it comes to the planning tasks, they are able to make an appropriate scheme which is likely to avoid failure. Moreover, brainstorming can bring efficient tacit knowledge sharing among members of the FV planner team, thereby drawing their potential opinions. In addition, to meet the varying needs of the society, perceiving and interpreting multi-stakeholder opinions are crucial for structuring an appropriate FV plan. The expectations from different type of stakeholders such as residents, related companies, and land owners can be acknowledged by open communications and informal intercoursers.

(2) Externalization process

Such tacit knowledge is articulated into explicit knowledge through the process of externalization (Nonaka & Toyama, 2003). The FV planner team transfers the tacit knowledge acquired from previous processes to explicit knowledge at a conceptual level. The approaches mainly include induction, deduction, interpretation, and experience feedback. This process is vital to the following aspects: embedding tacit knowledge like desires and appeals in explicit knowledge like sustainable development principles and key performance indicators; transforming attitudes of the organizations such as governments and transport departments into standards and regulations for guiding of FV projects; planting experiences and skills in proposed planning tasks.

The externalization process yields conceptual knowledge with explicit articulations using images, symbols, and language. Concepts knowledge involves tasks framing, sustainable development principles, standards and regulations, key performance indicators.

(3) Combination process

Two parts of explicit knowledge will be combined and processed in this process. One part is the explicit knowledge generated through the externalization process, which has been stored in the FV planner team. The other part is the explicit knowledge from external organizations within the “ba”, e.g. the handbook for FV planning, FVs research reports, reference books of logistics technologies, environmental standards, city traffic planning, past projects record (usually offered by research institutes). Explicit knowledge is collected from the inside of FV planner team or the surroundings and then mobilized, combined, edited or innovated. This process results in systemic knowledge which is more complex explicit knowledge. The systemic knowledge assets comprise packages of explicit knowledge such as infrastructure necessities, FV layout with sustainability considerations, business plan, scale of involved services, management modes including funding sources and administrative structure.

(4) Internalization process

Explicit knowledge created and shared throughout the FV planner team is then converted into tacit knowledge in the internalization process. Planners internalize knowledge and learn by praxis to solid their tacit knowledge foundation. This process has positive influences on the new venture performance of FV projects planning, as experts in the FV field will be educated based on their enriched internalized knowledge. Therefore, internalized knowledge becomes a strategic asset throughout the “whole life” of any FV. The praxis could be in the form of interactive activities (workshop, regular meeting, and team work) or conducted by information platform (groupware system, knowledge base). In this process, knowledge is applied in practical planning actions. It becomes the base residing in individuals (members of the FV planner team) for new routines in the forthcoming FV projects. Routine knowledge in this context may involve: (i) renewed ideas about FVs, which indicate having a good grasp of the new concepts; (ii) upgraded skills in the planning work, e.g. progress in planners’ professional skills such as location selection and infrastructure design; (iii) applicative capability, which can be obtained as routine knowledge due to the fact that praxis-based knowledge is more applicable for the practical situation of diverse FV projects; and (iv) creative capability offer opportunities for innovations in the FV project planning, e.g. using new energy-efficient materials in warehouse, implementing bar code and RFID technologies in cargo tracing, upgrading equipments for more efficient loading and unloading.

A spiral is formed along with the movement through the four modes of knowledge conversion. However, it is not a circle. In the spiral of knowledge creation, the interaction between tacit and explicit knowledge is amplified through the four modes of knowledge conversion (Nonaka & Toyama, 2003). According to this perspective, FV planners share and create knowledge within their team. Meanwhile they constantly access and communicate with the “ba” so as to establish a solid foundation for final decision making. Through dynamic interactions among planners, knowledge created by the FV planning team can drive the mobilization of knowledge held by external constituents such as customers, related companies, universities, or transport departments. The plan built upon the amplified knowledge base will greatly balance multiple stakeholders’ interests, thereby probably bringing sustainability-oriented benefits of the proposed FV.

5.3.3 Decision making

Decision making in this research refers to the process of selecting from a set of options, after iterating changes of detailed FV plan. The selected solution should most likely generate sustainability contributions. Nowadays the decision environments have shifted from static and laboratory decision environments to dynamic and commercial business world ones (Yima, et al., 2004). In a broad sense, generally decision making deals with capabilities underpinned on interpreted information (i.e. knowledge) (Frazzon & Scholz-Reiter, 2009). Hence, a fluid mix of framed experiences, values, contextual information, expert insights, and intuition provides an environment and framework for evaluating and incorporating new experiences and information for final decisions (Tiwana, 2002). Accordingly, decision making in FV project planning is the continuum of sense making and knowledge creation. Figure 5-8 describes an integrated continuum and the decision making process.

The decision making process is related to four phases: intelligence, design, choice, and implementation (Simon, 1977).

The first phase, intelligence is embedded in the preparation of decision making of the FV project plan. It represents the sense making process of feasibility examination of a new FV project and the orientation defining of the proposed project. In this phase, it is also clear that where planners can collect knowledge surrounding them since useful knowledge is usually created by collection and generation. Previous sections in this chapter have detailed this phase, which lays a foundation providing intelligence for a desirable plan.

The second phase, design, is the phase where alternative courses of action are formed with sustainability considerations of FV projects. First and foremost, the planner team must identify the components which constitute a FV project plan. A series of components are included such as site, size, facilities, funds, layout, and external relations. Then, relying on the knowledge base shaped in the intelligent phase, alternatives for each component are proposed.

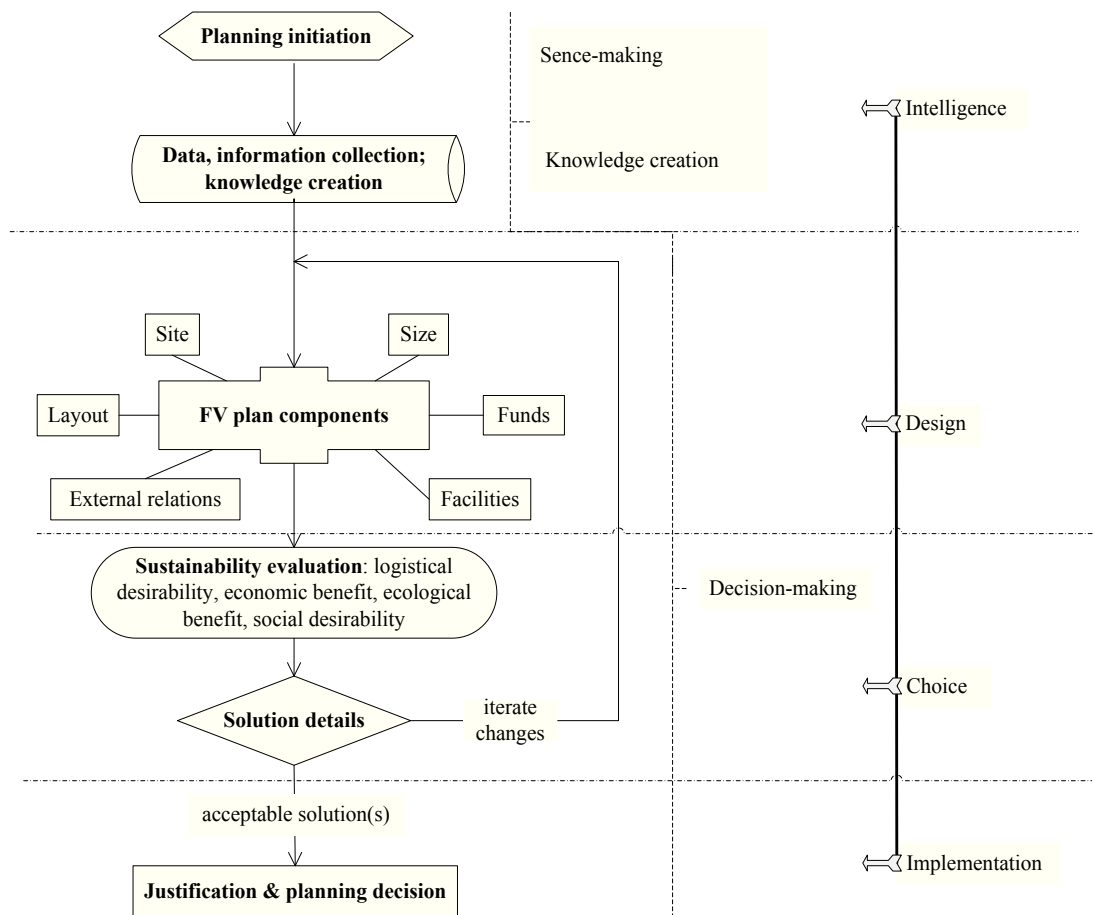


Figure 5-8 Decision making of FV project plan

The third phase, choice, is the phase where planners select the solution from each component's alternatives. In this phase, the planners can also return to any of the earlier stages to reformulate new alternatives because of additional information (Holsapple & Whinston, 1996). Specifically, there are two issues are essential including the principles for making choice of each component in FV project's plan, and the evaluation criterion considering FV sustainability consequences.

Table 5-1 offers the principles and impact factors for the choice of each component and their responding approaches (mathematics models or empirical results). Besides, the bottom box lists a checklist of main evaluation criterion for choosing taking into account

the logistical desirability, economic benefit, ecological benefit, and social desirability. According to the evaluation criterion, detailed solutions are adjusted iteratively based on these principles and impact factors.

Table 5-1 Components and sustainability evaluation criterion of FV planning

Components	Principles and impact factors	Approaches
Site	<ul style="list-style-type: none"> - Comply with the regional master plan - Be at intermodal nodes - Be in traffic hubs - Consideration of land price - Better be in suburban area - Accessibility to labour - Suitable natural conditions - Coordinate with industries 	<ul style="list-style-type: none"> - Linear location model - Convex non-linear location model - Concave non-linear location model (Sirikijpanichkul & Ferreira, 2005) - Fuzzy comprehensive evaluation model - Artificial neural networks model - Delphi method
Size	<ul style="list-style-type: none"> - Site service items - Internal functional divisions - Market requirement - Haul distance and costs - Land-use price and limitations - Impacting scope - Volume forecast of potential cargoes - Green land area 	<ul style="list-style-type: none"> - Relevant to actual situation - Avoid extremely pursuing bigger size - Referring to successful cases - Data envelopment analysis (DEA) - Mathematical models and simulation
Facilities	<ul style="list-style-type: none"> - Buildings - Internal roads - Operational devices - Intermodal infrastructure - Information network 	<ul style="list-style-type: none"> - Imitate perceived best practices - Increase investments in green facilities - Cooperate with universities and research institutes - Communicate with experts
Funds	<ul style="list-style-type: none"> - Land acquisition cost - Total construction cost - Equipment acquisition cost (D. A. Tsamboulas & Kapros, 2003) - Advertising campaigns cost 	<ul style="list-style-type: none"> - Governments' investment - Enterprises' investment - Property developer' investment - Public-private partnerships (PPP)
Layout	<ul style="list-style-type: none"> - Functional services - Functional orientations - Reservation for further development - Staged construction sections - Relations among functional zones 	<ul style="list-style-type: none"> - Market segmentation analysis - Induction and classification of market requirements - Computerized layout design method
External relations	<ul style="list-style-type: none"> - Connecting to public traffic - Collaborate with other FVs - Interact with other transports nodes - Interaction with industrial chains 	<ul style="list-style-type: none"> - Integration into urban master plan - Bring logistics into regional economics - According to industrial structure - Establish information platform - Fitting organizational structures
Sustainability evaluation criterion <ul style="list-style-type: none"> □ Logistical (operational) desirability: (i) traffic journeys minimization, (ii) transport intermodality, (iii) co-operative services offered, (iv) infrastructure conditions □ Economic benefit: (i) cost savings for telecom, energy, (ii) potential opportunities for 3PLs, (iii) capability of potential cargo, (iv) commercial revenue, (v) added values (ISL, 2010) □ Ecological benefit: (i) less negative effects of transport on the ecological environment, (ii) clean production, (iii) reuse of brownfield or wasteland □ Social desirability: (i) promote industrial development, (ii) harmonious neighbourhood, (iii) job opportunities for local residents, (iv) mitigate the traffic congestion, (v) decrease traffic accidents 		

The last phase, implementation, put the choices of each components into final results in FV's detail planning. In this phase, the decision making is culminated by the implementation of the plan orienting sustainable development. Moreover, the follow-up actions like tendering and promotion of the plan will come up to the accomplishing of a FV project planning stage. However, it is worthy noted that the modifications of the plan already made should be necessary due to the often changing situations during the actual realization process of the plan.

5.4 Summary

This chapter regards sustainability value as the orientation of a FV project combining logistics, social, ecological, and economic goals. FV project planning is a kind of strategic architecture or blueprint, which creates the proper combinations of 3PLs, infrastructure, technologies, skills, resources and legal context to pursue sustainability values. It is suggested that the FV planning stage should be well-organized, appropriately responsive to the actual demands, local environment and national status.

FV project planning is knowledge-intensive, which requires a mix of knowledge from inter-disciplinary and personal skills. Regarding a long-term sustainable development, FV projects are planned depending largely on the knowledge collected from related departments and organizations. KM is an essential enabler of proper FV project planning, since KM could be utilized as a tool for investigating the circumstance, creating alternatives, and making decisions. Adapting to the processes in FV planning stage, this chapter draws on the “sense-making KM model” for FVs planning towards sustainable development in a more organized way.

CHAPTER 6

Converting knowledge into sustainability performance of freight villages

There are various obstacles and challenges in bringing sustainability to the FV development due to the complexity and uncertainty of problems crossing economic, environmental, and social dimensions. The challenges posed are both conceptual and practical. Regarding this, it seems necessary to take into account different sources of knowledge.

Knowledge is increasingly recognized and accepted as a fundamental resource in the logistics field. Knowledge-related resource of FVs is relevant to their potential ability for adapting changing situations and values as well as acquiring new skills and knowledge. Sustainability-oriented issues of FVs are dependent on the KM execution involving sustainability awareness building, stakeholder information exchanging, state-of-the-art technologies using especially eco-friendly technologies, theoretical guidance, and professional education.

6.1 Discussing knowledge and KM in logistics and FVs

The integration of knowledge-related topics (e.g. IT, learning, knowledge sharing, and knowledge acquisition) into the logistics field is gradually recognized by people, though they have yet to draw much attention from the FV perspective. Esper, et al. (2007) point out five dynamic capabilities which are all vital for the continuous development of the bundling of logistics processes and IT systems. They are managerial knowledge and presence, cross-functional teamwork, control, learning, supply chain relationships. A range of logistics capabilities are identified including customer focus, supply management, integration, measurement, and information exchange. Elbert, et al. (2009) argue that through an exchange of knowledge and experience with other FV percipients impulses changes in the FV. As a result, an enhanced transfer of best practice solution is brought to different areas of logistics, structures and process.

As most researchers mentioned, intuitively a FV is a cluster of freight-related business. This definitely brings FV concept into the industrial cluster view. However, there are several distinctions of FVs from general industrial clusters are proposed:

- Double nature of FV: public logistics node and commercial entity
- Twofold meanings of sustainability
- Depends largely on the facilities and infrastructure
- Services-base for general industries
- Governments and public sectors intervention
- Key role of information/knowledge in leveraging agile performance of logistics and supply chains

Considering the above distinctions, two characteristics of KM in the contexts of logistics industry, supply chain and FVs are identified:

(1) Multi-levels knowledge mapping

The concept of logistics has evolved from a mere goods handling activity to a strategic operation of a company. On this basis, regions and countries are going to be more competitive. Therefore, the logistics development is increasingly related to multi-levels knowledge resource and knowledge holders. In view of FVs' double nature multi-levels knowledge mapping becomes a distinct characteristic of KM in the FV field. First, the policy knowledge refers to the top-down regulations and policies functioning at government levels. Second, the FV concept has only existed for several decades, and the logistics discipline itself is a quite young and very dynamic field. This requires ongoing knowledge supplement and scientific explorations for educating qualified logisticians. Third, innovative knowledge probably enables the settled enterprises in FVs to lead in a way that clearly differentiates them from anybody else. Fourth, externalities knowledge, the knowing about logistics activities impacts on global warming (increasing contribution of transport to CO₂ emissions), air, water and noise pollutions, traffic congestion and accidents. Fifth, administrative knowledge is used in conjunction with the support operations in FVs. In addition, operational knowledge relates to the information chains coming with the operational process in FVs including transshipment, unloading, storage, cargo handling, package, and transportation.

(2) Collaborative KM in logistics and supply chain management

Collaboration is gaining attentions in supply chain management, thus information intensive and multi-cultured environments become essential for logistics activities. Logistics and supply chain management today emphasize the integration across multiple sectors or organizations. It makes for knowing about quality standards and database requirements of suppliers or customers, stock control procedures, and transportation

information. A collaborative KM culture is able to bring about supportive business relationships regarding supply chains. Moreover, collaborative KM can deal with the Bullwhip effect by knowledge sharing. The bullwhip effect is a near-hand term for a dynamical phenomenon in supply chains. The information in supply chains usually includes details on the nature of the goods, quality, health and origin certificates, safety and other handling instructions, destination, shipper, receiver, intended modes for hinterland transport, and required arrival date and time. At present, such information is not regularly available to container terminals, or hinterland transport operators, until the very last moment (Veenstra, et al., 2012). In order to integrate trading agents for the reliability, a collaborative KM environment plays an important role in the logistics and supply chain management field (Maqsood, et al., 2003). FVs are parts of a large freight network, but there are differences into which extent they collaborate with each other. Collaborative KM has a significant impact on supply chain learning and information dissemination across multiple segments along the logistics and supply chain operations conducted by FVs.

6.2 KM process implementation

Concerning the above implications, this section focuses on the KM implementation in FVs for converting knowledge into sustainability performance. KM strategy is not an option but a necessity for FV operators and decision makers to consider. They are able to obtain knowledge through both cooperative and competitive networks. The acquired knowledge potentially facilitates the enhancement of logistics values and sustainability contributions to the community/region (Lee & Song, 2010). A KM process framework is showed in Figure 6-1 which acts the leverage for FV sustainability. In which, KM process, FV activities, and FV sustainability performances are outlined.

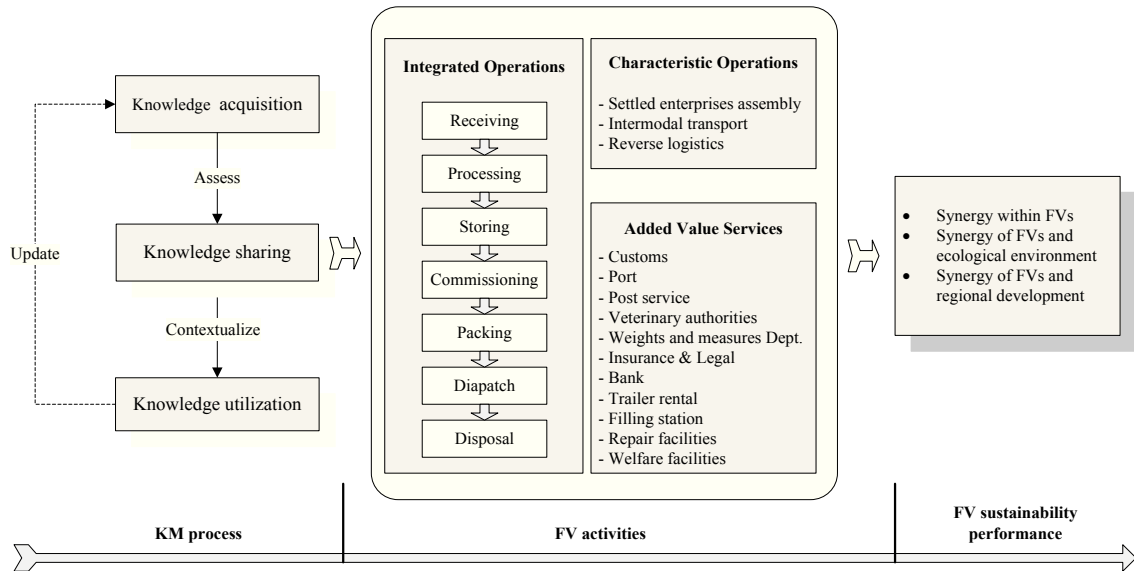


Figure 6-1 Framework of KM process for driving FVs sustainability performance

Synergy effects directly represent the sustainability value of FVs, which are embedded in three layers: synergy of firms within a FV, synergy of FVs and ecological environment, synergy of FVs and regional development.

(1) Synergy of firms within a FV

There are two major types of inter-firm relationships that both contribute to the success of clusters and emerge as a result of agglomeration: vertical and horizontal (Higgins & Ferguson, 2011). In this research, vertical relationships look at the links between firms along the logistics service chain “receiving, processing, storing, commissioning, packing, dispatch, disposal”. Besides, with the functional diversification expansion in FVs, another kind of units increasingly appears in FVs. They provide added value services, such as customs, port, post-services, and veterinary authorities. Their vertical synergy greatly increases a FV’s attractiveness for more private funds and customer preference. Meanwhile, horizontal relationships represent those business agreements between firms that have “parallel” or cooperating positions in the logistics process or added value services. Horizontal synergy promisingly reduces “cutthroat competition” among parallel firms within a FV and thus improve the whole’ capability.

FV Management Company functions as a communication platform for exchange of experiences for service structures and development (DGG, 2009). Synergy of firms within a FV is probably strengthened by knowing the conditions of upstream and downstream sections, also by collecting valuable information or skills about their suppliers, customers, cooperative partners, as well as business and political environments.

(2) Synergy of FVs and ecological environment

Intermodal transport and reverse logistics are major enablers in this aspect. This requires a process or systems approach for execution and “a higher degree of skill and broader knowledge of the transportation/supply chain processes...information, equipment, and infrastructure” (Dewitt & Clinger, 2007). Due to the distributed nature of actors and information resources involved in intermodal transport, the need for efficient KM is imperative. Besides, in the reverse logistics, KM integrates information from external and internal elements of the management process of the product returned. KM also aids to allies in reverse logistics to make appropriate choices, support the process, and manage partnerships (Wadhwa & Madaan, 2007).

(3) Synergy of FVs and regional development

FVs have become an important part of the logistics industry in a region. Since the share of logistics costs to GDP mirrors the efficiency of regional economy to a great extent, the synergy between FVs and regional development is gaining much attention from city/town planners and local authorities. They engage in guiding and adjusting FVs' behaviours, so as to establish related standards and avoid low-quality FVs. City/town planners and local authorities are in charge of the connection and allocation of freight resources (road, railway, waterway, and air), reserve of key strategic materials and emergency supplies. They also promote the interactions between different FVs at the regional level. Meanwhile, complying with related regulations and laws, FVs tend to be attached most importance by policy supports as well as public and private investments.

To achieve the maximum synergy of FVs and regional development, FVs should be proactive in “understanding” the trend of policies formulated by governments. Meanwhile the operation situations especially bottlenecks of FV development should be exposed to local authorities. Moreover, governments and local authorities keep contact with FV operations within their jurisdictions. Accordingly, they can access more information about FV practices, which greatly helps to readjust the planning of regional logistics activities and other industries development strategies.

KM mainly facilitates such synergy effects mentioned above. Most of researchers use the terms of knowledge and information interchangeably, emphasizing that there is not much practical utility in distinguishing knowledge from information in knowledge sharing research. This research adopts this point of view. Knowledge can be viewed as information which is processed by individuals and organizations relevant to their

performance, e.g. ideas, facts, expertise, and judgments. In this research, an integrated KM cycle is distilled consisting of three processes: (i) knowledge acquisition, (ii) knowledge sharing and dissemination, and (iii) knowledge utilization.

Table 6-1 summarizes the three KM processes with their relevance to sustainable behaviours of FVs. Knowledge acquisition brings about the development and creation of insights, skills, and relationships. In the transition from knowledge acquisition to knowledge sharing, the knowledge content is assessed. Knowledge sharing disseminates and makes available what is already known. Knowledge is then contextualized in order to be used (“utilization”) (Dalkir, 2005).

Table 6-1 KM process and relevance to FVs sustainable behaviours

Process	Main points	Relevance to FVs sustainable activities
Knowledge acquisition	Identification and subsequent codification (or creation) of existing internal knowledge and know-how within the organization and/or external knowledge from the environment (Dalkir, 2005)	Make the knowledge visible in FVs; Knowing status of logistics market and customer preference; Recognize the value of new knowledge for lifting logistics services efficiency; Track the policies and regulations on transportation; Learn experience of successful FVs cases
Knowledge sharing	Processes of transferring, disseminating and distributing knowledge in order to make it available to those who need it (Massa & Testa, 2009)	Balance competition and cooperation among peer enterprises within the FV; Create synergies of different sectors in FVs; Promote interactions with other FVs and local authorizes
Knowledge utilization	Incorporation of knowledge into an organization's products, services and practices to derive value from it (Huber, 1991)	Clean production process, reverse logistics; Green packaging and warehouse; Low-emission vehicles and alternative fuels; Eco-friendly intermodal solutions; Improve technology-based service; Regulate FV's public behaviours

6.2.1 Stakeholder identification

Sustainability, as the combination of economic, ecological, and social requirements, cannot be achieved without the involvement of multiple stakeholders. Sustainable development can only be given real meaning and realized through a multi-stakeholder approach (Rotheroe, et al., 2003). Freeman (1984) defines stakeholders as “any group or individual who can affect or is affected by the achievement of the organization's objectives”. Stakeholders, then, are much more than just “interested parties.” They put something in (“contributions”) and in return they get something out (“inducements”).

In spite of the purpose of any action's effort, identifying stakeholders and their interests should be the first. Stakeholders may differ for each specific “script” examined by the organization. Different organizations may face different stakeholders. Furthermore,

different “scripts” also result in different relations between stakeholder groups (Polonsky, 1995). It is worth noting that the ecological environment is increasingly regarded as a kind of stakeholder influencing business and thus the stakeholder definition is broadened (Ayuso, et al., 2006; Driscoll & Starik, 2004).

There are various categories of stakeholders, and Table 6-2 offers several options to classify stakeholders.

Table 6-2 Stakeholders categories

Stakeholder category	Literature
Internal, buyers, suppliers, and lateral	(Morgan & Hunt, 1994)
Customer, community, stockholders, government, and employees.	(Lerner & Fryxell, 1994)
Governments, investors, political groups, suppliers, customers, trade associations, employees, and communities.	(Donaldson & Preston, 1995)
Primary and secondary stakeholders	(Clarkson, 1995)
Regulatory, organizational, community, the media	(Henriques & Sadosky, 1999)
Primary stakeholders that constitute the business (owners, employees, customers and suppliers); Critical secondary stakeholders on whom the business depends for infrastructure (e.g. communities and governments)	(Waddock, 2001)

In the context of FVs, Kapros, et al. (2005) argue that although there are numerous stakeholders directly related to the development of FVs, most of them can be grouped into five categories: (i) owners or managers, (ii) potential users, (iii) other transport actors, (iv) local authorities, and (v) special interest groups.

This research identifies three scopes of stakeholders concerning a FV (see Figure 6-2). They are primary stakeholders, correlative stakeholders, and influential stakeholders. Primary stakeholders are individuals or organizations who directly operate with or benefit from a FV, including investors, settled companies, and FV Management Company/Association. Correlative stakeholders are individuals or organizations whom the FV interacts with to generate benefits in a broader meaning, consisting of customers, public transport departments, transport nodes, other FVs, industrial groups, nearby residents, and natural environment. Influential stakeholders are individuals or organizations that influence FV operations in wide environments relating to policy, financial, technology, professional guidelines, and social morality. The influential stakeholders probably are state government, local authorities, professional associations, financial supporters, fiscal providers, universities and research institutions, and NGOs.

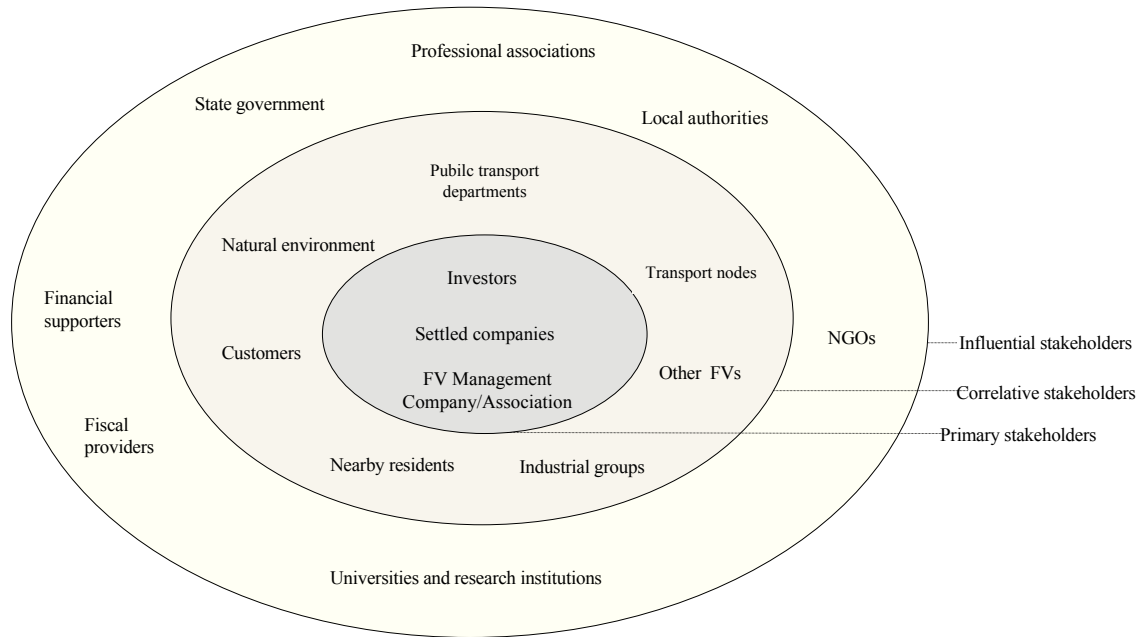


Figure 6-2 A general stakeholder map for a sustainability-orientated FV

Various environmental problems and social issues of FVs pose a real challenge to the traditional scientific knowledge, because they are associated with such aspects: (i) agglomeration and clustering issue, (ii) inter-regional operations, and (iii) coordination with urban development scheme. In consequence, from the outset, the process of developing the master plan aims to link up players from the industry, academia, government, and civil society on a broad basis and to overcome structures of thinking and working that are “set in stone” (BMVBS, 2008).

Facing this challenge, there is a considerable shift in management approaches to FVs sustainability performance, moving from management informed by reductionist ideas to a post-normal science associated with the erosion of boundaries between different forms of knowledge and rationality and the coupling of social and ecological systems (Raymond, et al., 2010). This shift is reflected in concepts such as stakeholder engagement, knowledge networks, and sustainability training and education. Thus, in the context of FVs, knowledge/information-related activities toward sustainability are definitely driven by stakeholder engagement.

6.2.2 Knowledge acquisition

Knowledge acquisition is “the process by which knowledge is obtained” (Huber, 1991). It identifies and subsequently codifies (or create) existing internal knowledge and/or external knowledge, and know-how within the organization. In this research, knowledge acquisition is defined as a process by which organizations (firms and other departments

and sectors) in FVs obtain new knowledge from their external environments (other organizations relevant to FVs and public environments). The acquired knowledge does not have to be newly created, just new to the FVs' existing "knowledge warehouse". Basically the advantage of knowledge acquisition is the elicitation, collection, analysis, modelling, and validation of scattering knowledge in settled enterprises and auxiliary agents in FVs, as well as the external knowledge absorption. Especially the knowledge acquired from external environments is crucial, since normally they are the information mirroring market demands and customer preferences. They also report new knowledge generated by external commercial or research organizations for enhancing logistics services efficiency, policies and regulations on transportation sector, as well as best practice and experiences provided by successful FVs.

Table 6-3 summarizes the sources of knowledge which can be acquired and may potentially become knowledge assets for FVs. Four levels of knowledge assets are covered: environmental knowledge, human knowledge, structural knowledge, and relationship knowledge. According to the four levels, knowledge assets are detailed following their sub-levels to represent the sources for knowledge acquisition.

Table 6-3 Sources of knowledge acquisition

Levels	Sub-levels	Content of knowledge assets
Environmental knowledge	Insights of business environment	Status quo of regional logistics market; Transport policies; Potential customers information; Background of distribution agents; Trends of competitors (i.e. other FVs); Current commercial business models
	Interpretation of social and ecological environments	Sense of air pollution, noise, traffic accidents caused by fleet increase; Understanding of low-carbon and sustainable economy; Reorganization of FV functions facing traffic congestion
Human knowledge	Organizational capital	FV objects definition and value orientation; Cultural atmosphere; Eco-friendly management methods and technologies; Ongoing formal and informal training and education; Impediments and bottlenecks to organizational growth
	Individual capital	Professional ability on cost/time, reliability, flexibility; Personal environmental awareness; Competency and adaptability for the job; Learning ability and innovation potentials

(following Table 6-3 in the next page)

(following Table 6-3)

Levels	Sub-levels	Content of knowledge assets
Structural knowledge	Products and services	Understanding of standard services, advanced services, complete services, integrated services in FVs; Intermodal transportation operations and simulation; Experiences of waste logistics and reverse logistics; Life-cycle of products; Green products innovation
	Business management	FV regulatory structure; KM execution; Investment management skills; Performance management capability, audit and review
	Supportive technologies	Specialized IT software for operational management; Application level of RFID, automatics, intelligent; Information and communication technology (ICT); Database maintenance capability
Relationship knowledge	External stakeholder relationships	External stakeholders identification (e.g. customers, government, community, special groups, other FVs); Positioning stakeholders about interests and requirements; Skills and experiences for collaborative relationships
	Internal stakeholder relationships	Internal stakeholders identification (e.g. board members, employees, management layer, shareholders, settled companies); Knowing of requirements and dynamics; Ability in establishing trust, loyalty, and communication

6.2.3 Knowledge sharing

Knowledge is inventoried after the process of acquisition. The next crucial step is to present an assessment against selection criteria that will closely follow the organizational goals. Is this content valid? Is it new or better? That is, is it of sufficient value to the organization such that it should be added to the store of intellectual capital (Dalkir, 2005)? In the context of sustainability performance of FVs, the assessment takes “logistics efficiency and effectiveness,” “economic benefits,” “eco-environmental protection,” and “social contribution” into consideration. On the basis of the assessment, knowledge of potential values toward FVs sustainability is involved in the store of intellectual capital (knowledge assets).

Through the process of knowledge acquisition, settled enterprises and auxiliary agents in FVs hold the knowledge that they need. Then, knowledge sharing is an important part in the subject of KM, through which one unit is affected by the experience of another (Argote & Ingram, 2000). It is referred to as the processes of transferring, disseminating, and distributing knowledge in order to make it available to those who need it. Knowledge sharing provides task information and know-how to help others or to collaborate with others to solve problems, develop new ideas, or to execute policies and

procedures.

An efficient knowledge sharing approach is more imperative than ever. It can coordinate the independent entities in a FV or relevant to FV operations as well as prevent the bullwhip effect. These independent entities refer to the enterprises and auxiliary entities within a FV, and external entities interacting with this FV within its impacting scope such as networked FVs, city traffic planners, industries, universities, and research institutions. Knowledge sharing in FVs can be in forms of: intra-enterprise species within the FV, inter-enterprise species within the FV, knowledge sharing between FVs and external related entities. Successful knowledge sharing will enrich the whole knowledge stock of FVs. It will establish the “mutualistic symbiosis” of enterprises species within a FV, create synergies of different enterprises species within the FV, and promote positive interactions. These three forms of knowledge sharing are interrelated (see Figure 6-3).

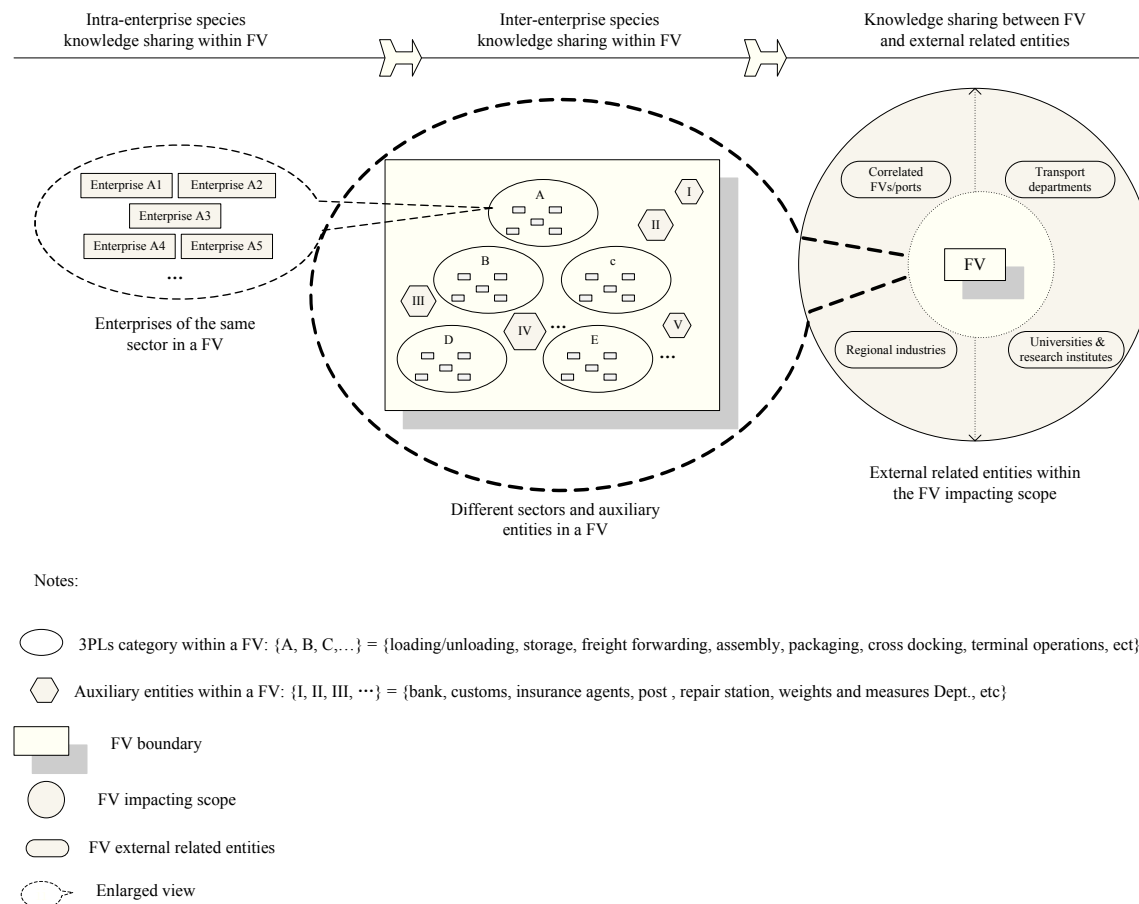


Figure 6-3 Interrelated three contexts of FVs knowledge sharing

(1) Intra-enterprise species knowledge sharing within FVs

It refers to the knowledge sharing among the enterprises in a “peer group”. These

“peer groups” are divided according to their service contents, e.g. loading/unloading, storage, freight forwarding, assembly and packaging, cross-docking, terminal operations. Technical and customers’ (or market) information becomes the core content of the knowledge sharing among them. The “cluster” characteristic requires the alliances of peer enterprises in FVs rather than fierce competitions. The technical performance of these enterprises species is essential for attracting more customers to establish business relationships as well as for reducing their own risks by consolidated shipments and consolidated warehouse. Furthermore, through knowledge sharing, it is likely to facilitate consensus on the logistics activities in line with sustainable development principles, for example, the purchase decision and utilization of eco-friendly forklifts, executive safety standards on storage and package/repackage of hazardous materials, clean distribution processing, optimization of multimodal transport routing and vehicle capacity utilization, reducing empty trips, sharing expertise, rapid cross-docking, and staff development plan. In all, intra-enterprises species knowledge sharing is vital in its own right and also it is embedded in the context of inter-enterprises species (within FV) knowledge sharing.

(2) Inter-enterprise species knowledge sharing within FVs

On the basis of intra-enterprise species knowledge sharing, the integration of inter-enterprise species knowledge sharing is important for the whole FV performance. It means knowledge sharing among different enterprise sectors. Considering the service ranges offered by FVs, strengthening relationships among the different enterprise species or units are crucial. As mentioned above, nowadays, the integrated operations inside a FV generate a chain of linked logistics activities including receiving, processing, storing, commissioning, packing, dispatch, and disposal. Besides, the auxiliary parts inside a FV (e.g. bank, customs, insurance agents, post, repair station, weights and measures Dept.) offer supportive activities for conveniences and efficiency of logistics operations. As a result, almost the whole services for a supply chain could be fulfilled by FVs. Therefore, successful knowledge sharing can smooth supply chains and enable organized activities in FVs. Inter-enterprise species knowledge sharing within FV has the potential to enhance the cohesiveness of FVs, thereby consolidating the position of the FV in its regional logistics system and better integrating itself into the context of knowledge sharing with external entities.

(3) Knowledge sharing between FV and the external related entities

Coupling effects are created by the interactions between the FV and its external

related entities, e.g. correlated FVs/ports, transport departments, regional industries, universities and research institutes.

- **Knowledge sharing between FV and correlated FVs/ports**

With the logistics service expansion in the global market, FVs have to cooperate with other FVs or ports to increase the market share, especially in the long cross-border transport chains. Usually, the logistics network is constituted by the nodes mainly in the form of FVs and ports. These interconnected logistics nodes are increasingly required to cooperate to undertake logistics tasks. Knowing about each other and trust among them ensure that the entire freight distribution network operate efficiently. Figure 6-4 roughly describes the location of GVZ Bremen and its connected FVs and seaports. As one of the most successful examples of FVs in Europe, in a central spot among North Sea ports, GVZ Bremen enjoys an ideal geographical location. With the operations of newly established JadeWeserPort, Bremen will be in the middle of the three major harbours in Bremerhaven, Wilhelmshaven, and Hamburg. On the way to North Sea, there are ports of Cuxhaven and Brunsbüttel located. GVZ Bremen distributes goods southwards to German cities like Osnabrück and Hannover. Facilitating knowledge sharing of among these nodes is helpful to increase the efficiency and quality of operations. As a result, the significance of GVZ Bremen as a logistics hub can be expected to increase as drastically as the volume of the flow of commodities (Via-Bremen, 2012).

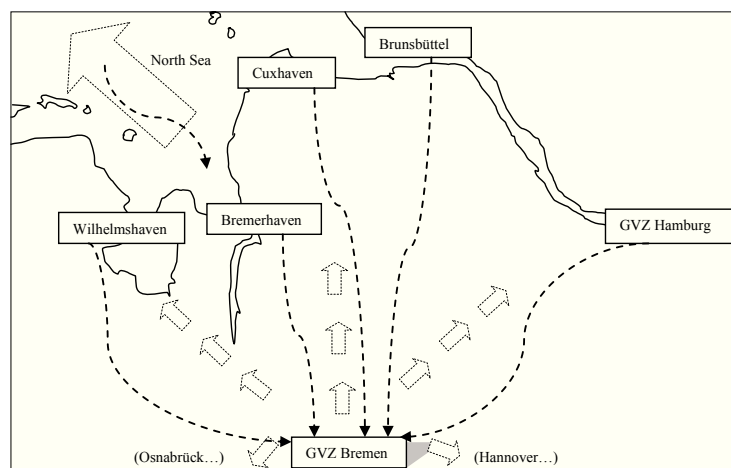


Figure 6-4 Correlated FVs/ports with GVZ Bremen

Source: <http://www.gvz-bremen.de/>

- **Knowledge sharing between FV and transport departments**

The intermodality-based FVs are strongly associated with various transport departments (road, rail, waterway, and air). More and more countries or regions regard

FVs as an important part in their logistics strategies and projects. In response to this, governments' attention and investments in national/regional transport systems are the leverage for FV development. Effective knowledge sharing between FVs and transport departments is crucial for establishing an efficient country-wide traffic network or a regional logistics system. It is encouraged to optimize communications between transport policymakers (e.g. transport departments) and logistics operators (e.g. FVs, ports). In Germany, they realize that it is necessary to establish a permanent discussion group comprising representatives of the Federal Ministry of Transport, Building and Urban Development and, in particular, representatives from businesses and associations in the freight transport and logistics sector (BMVBS, 2010). Combined transport is designed to enhance the overall logistics system, so as to relieve congestion on the roads and ensure more eco-friendly transport operations. The intensified exchange of ideas and experience is able to promote the interactions between FVs and transport departments.

- **Knowledge sharing between FVs and regional industries**

FV has been widely considered as a vital contributor to regional industry growth and performance by both practitioners and researchers. As a regional logistics service cluster, a FV and its served industries are tightly bound up with each other. Any industry has its own specific requirements and needs on logistics services and often they differ from one industry to the other. In order to provide corresponding facilities and services, FVs operators ought to constantly access these industries to discover the individual logistics needs and requirements, thereby ensuring that all shipments reach their destinations on time and at cost. Similarly, companies in various industries can choose appropriate FVs to undertake their logistics tasks by knowing actual conditions. In addition, FVs tend to have extensive know-how of green supply chain management especially reverse logistics. FVs provide an advantageous condition to develop reverse logistics for regional industries. In fact, the majority of companies solve the reverse logistics relying on 3PLs, for example, SEARS Company outsources the return management to the Genco Shipping & Trading Limited; GM Company (General Motors) deals with reverse logistics in cooperation with UPS; 3M (Minnesota Mining and Manufacturing Corporation) Company outsources the reverse logistics to Genco and Gatx logistics enterprises, etc. A completed reverse logistics process consists of sections such as returns acceptance, returns analysis, returns disassembly, and disposal of disassemble materials. The value realization of reverse logistics depends on its ability to participate in one or more successful organizations, as

well as its ability to integrate the enterprise's complex network of reverse chains. In response to the trend of outsourcing reverse logistics, FVs will hopefully become a major part in reverse chains. A knowledge sharing approach is where knowledge is maintained at product level and is updated as the product moves across the various stages of its life cycle. This contributes to decision support for dealing with individual requirements of every product. Knowledge sharing also ensures that all individuals involved in return processes to access it (Wadhwa & Madaan, 2007).

- **Knowledge sharing between FVs and universities/research institutes**

Some industries, especially knowledge-intensive sectors, tend to enhance competitiveness through supplying technology and training specialized personnel. They increasingly attempt to collaborate with universities and research institutes (Khalozadeh, et al., 2011). The capitalization of knowledge concerns the transformation of knowledge into "social capital by academics, involving sectors of the university such as the departments of basic science" (Etzkowitz, 1997). From this point of view, the cooperation between the university and the industry brings about possibilities for contributing to the technological development. In recent decades, federal, state, and local governments have created a variety of mechanisms to encourage knowledge-based economic development. One of the mechanisms is the collaboration between universities/research institutes and the industry in the form of knowledge sharing. FVs represent the strength and advantages of logistics industry in a region to some extent. Their advanced quality necessitates the tight cooperation with universities/research institutes, with the purposes of yielding efficient logistics technologies, new craft and environmental equipments, and more qualified employees in the logistics sector. The knowledge sharing activities can be:

- University/research institutes and FVs exchange students for internships;
- Joint projects, some of which involve government participation and the use of specialized facilities;
- Specialized programs designed by the university/research institutes for continuing education and training of professionals in FVs;
- University/research institutes help FVs to learn more about technical skills in logistics system and supply chains;
- University/research institutes provide laboratory for modelling and simulation of transportation and warehousing;
- Improved approaches for more adaption to the logistics development are created by

the joint efforts in both of theory and practice explorations;

- Specialists from university/research institutes also hold positions in FVs, which can be a direct knowledge sharing way.

6.2.4 Knowledge utilization

Knowledge utilization is the process incorporating knowledge into an organization's products, services, and practices to derive values and realize their visions. Figure 6-5 depicts the path of knowledge utilization to achieve FV visions. In this research, FV visions are defined as: be a driver for alternative transport network configurations; social logistics cost reduction and logistics efficiency enhancement; integrations with the industry for the current situation improvements.

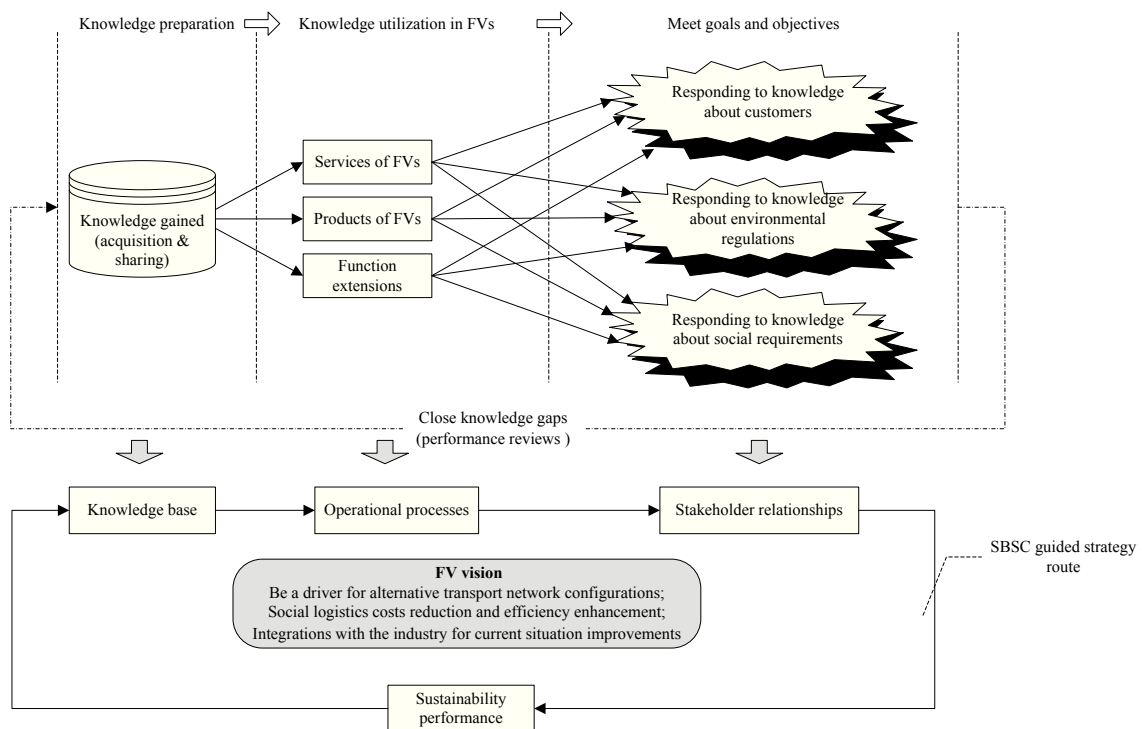


Figure 6-5 Knowledge utilization in achieving FV vision

Once knowledge is transferred to, or shared with others, it may be utilized through elaboration (the development of different interpretations), infusion (the identification of underlying issues), and thoroughness (the development of multiple understandings by different individuals or groups) in order to facilitate innovation, collective learning, individual learning, and/or collaborative problem-solving (King, 2009). These activities depend upon the knowledge base represented by the learning-and-growth perspective, and they are embedded in FVs' products, services, and extended social functions. The function extensions in this research are referred to as the synergic contributions beyond

typical activities of FVs, e.g. industrial development, regional economic growth, and community life improvement. Regarding the operational processes of FVs, the knowledge utilization toward sustainability usually focuses on: clean production process, reverse logistics; green packaging and warehousing; low-emission vehicles, eco-friendly intermodality, and alternative fuels; technology-based service improvement; normal public behaviours of FVs. Knowledge utilization directly affects the quality and efficiency of FV operational processes. Moreover, effective knowledge utilization is necessary for meeting the goals of FVs with responses to knowledge about customers, environmental regulations, and social requirements. Thus ideal stakeholder relationships can be probably established on the basis of these responses, due to the benefits of customers, ecological environment, and the society are the value realization of FVs in a broad meaning. Finally, a review of sustainability performance is an integral part for finding the knowledge gap in FV operations.

The knowledge utilization section makes a cycle combining the KM process with the FV sustainability realization. It can be viewed as a SBSC-guided strategy route to sustainable development of FVs. SBSC reflects the knowledge, skills, and systems that practitioners need (the learning-and-growth perspective) in order to innovate and build strategically adequate capabilities (operational process perspective) to satisfy customers, ecological environment, and the society (stakeholder relationships perspective). The ultimate goal is the increased values in sustainable development (sustainability perspective). The SBSC-guided strategy route should be able to assist FVs operators and decision makers. It becomes a helpful sustainable development management instrument integrating the optimal management of environmental resources and financial resources. SBSC offers a structure pursuing maximized FVs' potentials and giving managers an overview of the whole FV sustainability realization from the knowledge base and to knowledge utilization. It helps in implementing, monitoring, and evaluating of FVs sustainable development strategy with KM approach, using financial and nonfinancial indicators to achieve the sustainability performance (Mendes, et al., 2012).

6.3 Building FV sustainability capability

6.3.1 Roadmap of organizing KM for sustainable FVs

Considering the distinct characteristics including “multi-levels knowledge mapping” and “collaborative KM” in the context of logistics and FVs, a roadmap of organizing KM for

building FV sustainability capability is illustrated in Figure 6-6. A series of KM layers break FV's physical territory to a broader functioning scope. The backbone of this roadmap basically consists of the links of knowledge expansion, knowledge process, and knowledge gap discovery, which interact and are embedded within the SBSC-guided framework. FVs are able to build sustainability capabilities with the support of KM crossing the social foundation layer, functioning layer, and auditing layer. These layers are interdependent with each other. Table 6-4 details the three layers of KM approaches to sustainability-oriented FVs.

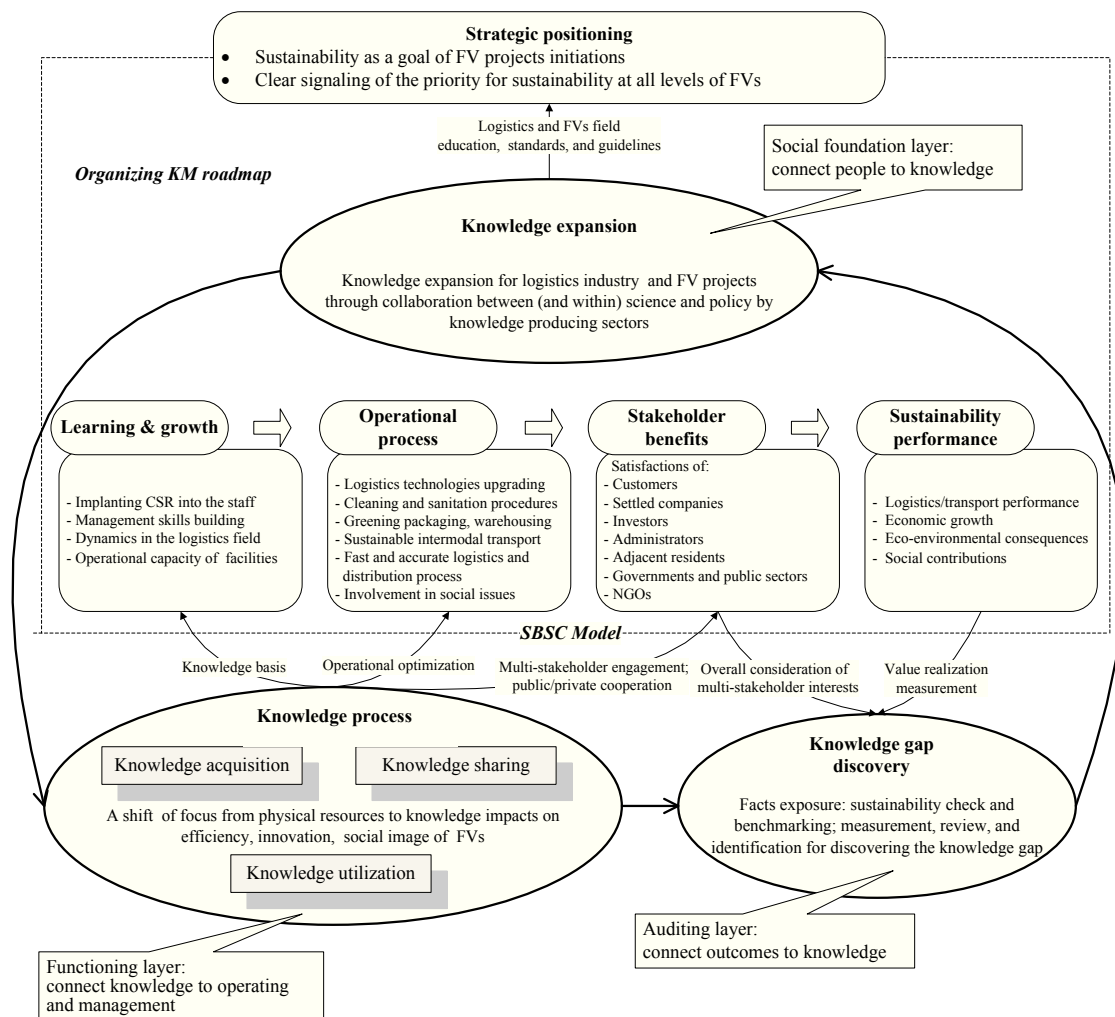


Figure 6-6 A roadmap of organizing KM for building FV sustainability capability

Table 6-4 Three layers of KM and approaches toward FV sustainability capability

Layers	Key points	Approaches
Social foundation layer	<ul style="list-style-type: none"> - Knowledge expansion - Connect people to knowledge - Preconditions guarantee 	<p>Consolidation of science knowledge in the logistics field, especially incorporation of interdisciplinary knowledge (Environmental science, Engineering, Economics, Management, Informatics, etc);</p> <p>Policy making in supporting eco-friendly FVs (preferential conditions such as reduction or exemption of tax, franchise, disciplines and measures);</p> <p>Directives for sustainable traffic, waste recycling, air and water pollution index;</p> <p>Diagnostic report (e.g. European Commission Transport: white paper);</p> <p>Education and training of logistician, tri-ability on theory, implementation and practice (see Figure 6-7).</p>
Functioning layer	<ul style="list-style-type: none"> - Knowledge process (acquisition, sharing, and utilization) - Connect knowledge to operating and management process - Execution guarantee 	<p>Creating learning culture in FVs and located enterprises;</p> <p>Position competence training system of the FV management, considering environmental management principles and standards;</p> <p>Direct contacts between settled firms and their customers;</p> <p>Application of green operations in existing products or processes (core processes, reverse logistics, network design, and waste management);</p> <p>Cooperation among different carriers and facility service providers;</p> <p>Vertical- and horizontal coordination to facilitate information and knowledge dissemination.</p>
Auditing layer	<ul style="list-style-type: none"> - Knowledge gap discovery - Connect results to knowledge - Continuity and sustainability guarantee 	<p>Tools application including ISO 14000, ISO 14031, the Natural Step approach, Triple Bottom Line Accounting, input-output analysis;</p> <p>Tracking record of performance information, e.g. avoided CO₂ emission between different alternative modes, CO₂ emission savings per ha marketed area, per employee, per enterprise, reduction potential in power consumption;</p> <p>Publications about performance checking and measurement (e.g. ranking of European FVs, Chinese FVs Investigation Reports in 2006, 2008, 2012):</p> <ul style="list-style-type: none"> - Lessons learned and case study of productive FVs; - Identification of potential optimization approaches; - Present the knowledge gap to knowledge producers.

A knowledge expansion results from KM at the social foundation layer. It connects people to knowledge providing adequate knowledge sources and basis for KM at the functioning layer within FVs. The latter transforms knowledge into expected results in actual operations. The auditing layer of KM is proposed to supplement the knowledge in the social foundation and readjust knowledge process at the functioning layer. The three layers of organizing KM in the context of FVs will be analysed in detail.

(1) KM at social foundation layer

KM at the social foundation layer concerns the accessibility of knowledge being available to people. Thus, people who engage in logistics and FV practices are able to

gain access to knowledge in the form of logistics-related science, policies, diagnostic reports, and education and training programs. “A knowledge age to follow” is emphasized, which becomes a precondition ensuring a growing and sound development in the logistics field. At this layer, moreover, it is a shift to cognition toward that knowledge is a limited resource rather than financial resource. Connecting knowledge to people requires the provided knowledge are framed and rooted in some principal public sectors, such as government, transport department, and education institutions. This layer enables the readjusting or creation of consciousness such as green logistics and supply chain management, CSR, and the formation of integrated logistics systems from industrial and social aspects. Besides, appropriate approaches to connect people to knowledge also include creating sustainability awareness through the media, setting up official eco-labelling system and corresponding promotions, and encouraging sustainable development execution especially in small and medium-sized enterprises (SMEs) by various incentives, e.g. tax exemption and service discounts.

(2) KM at functioning layer

KM at the functioning layer is referred to as the action on FV operations with the support of knowledge process especially on the administration, tasks and functions of logistics, and organization culture. From the resource-based view in business, it represents a shift of focus from physical resources to knowledge impacts on efficiency, innovation, social image of FVs. Knowledge process (acquisition, sharing, and utilization) refines FV operations including receiving, storing, packing, dispatch, reverse logistics and transport network design, and waste management. The right KM process may lead to a series of consequences. (i) A knowledge basis is provided for FV practitioners’ learning and growth, which consists of CSR and growing sustainability awareness implanted in the practitioners, improved adaptability and change management skills of the management in FV, updated knowledge acquisition relating to logistics theories and technologies, and the capability improvement in using FV facilities. (ii) Such results can be generated: operational optimization and innovative technological solutions in logistics (e.g. energy efficiency technologies, RFID, data acquisition technology, optical scanning); cleaning and sanitation procedures, reusable packaging and eco-labelling, energy-efficient warehousing; safety in transportation especially the transport of dangerous goods, which becomes a special concern in logistics in response to social and environmental sustainability; knowledge or experience of available transport modes, referring to which

to design sustainable intermodal solutions in particular for long-distance transport; information exchange among warehouse operators, forwarders, terminal operators, customs, so as to facilitate the logistics and distribution process to be fast, accurate, and cost-effective; contributions to social issues such as goods distribution in densely populated cities and agricultural logistics bottlenecks. (iii) Multi-stakeholder satisfaction is increased in pursuit of more balanced and sustainable growth. The sustainable development of FVs greatly depends on more balanced benefits of customers, settled companies, investors, administrators, neighbouring residents, governments, public sectors, and NGOs.

(3) KM at auditing layer

Sustainability auditing is arisen which is used to assess the sustainability performance of various organizations or entities. It calculates the environmental impacts produced by a certain goods or service into expenditure. Thus, KM at the auditing layer ensures the quality of outcomes examining by exposing facts. On the basis of valid data and information collected through the approaches of questionnaires, face-to-face interviews, statistical documents, FV specialists and managers should make an effort to measure, review, and be aware of FV sustainability performance. Accordingly, the horizontal and vertical comparisons pushing the knowledge gap discovery on the way to sustainable development. KM at the auditing level mirrors the formation process of knowledge as “data – information – knowledge”.

In practice, sustainability checking, reporting, and benchmarking have been applied in evaluating FV sustainability performance. For example, in order to examine the actual effects of green strategies in FVs, “Siemens Mobility and Logistics Division of the Infrastructure & Cities Sector” collects the information from such aspects: energy consumption (How much and for what does your FV consume energy?), energy mix (Where does the energy for your FV comes from?), energy saving technologies (What kind of technologies do you already use?), energy saving strategy (Do you have a clear energy efficiency target and strategy?), energy saving practice (How is energy efficiency embedded into your daily operation?). According to the data and information analysis, the actual effects of such green strategies in FVs are evaluated, which can be used as cases for learning, in other words, it is a kind of experience knowledge (Nestler, 2012). Another example relating to benchmarking in the project initiated by DGG is the ranking of European FVs 2010. FVs from over 30 countries were included. This benchmark study

involves data and information collection from respondents, information processing, and knowledge (measurement results, case experiences, implications, and benchmark) presenting. Through the information transfer, the results about the ranking of European FVs in 2010 are generated in the form of explicit knowledge existing in documents or webpage, in which, “Interporto Verona ranks No.1, with 211 points, GVZ Bremen ranks No.2, with 211 points, GVZ Nürnberg ranks No.3 with 205 points, etc” (Nobel, et al., 2010). Such kind of outcomes is thus changed into knowledge dominated by experience or lessons, which are potentials for the social foundation concerning the sustainable logistics-related aspect.

6.3.2 Checklist for building FV sustainability capability

The checklist (See Table 6-5) provides a set of guidelines for FV practitioners to convert knowledge into sustainability performance. The structure of this checklist is developed from SBSC introduced previously as well as built on FVs practical experiences and KM implementation.

Table 6-5 Checklist for building FV sustainability capability

Learning and growth “The foundation for all strategy” (Kaplan & Norton, 2001), including sustainability-oriented strategy; Basis of FVs competency, use of technology infrastructure, atmosphere for sustainable actions
<input type="checkbox"/> An increasing awareness that potential benefits are embedded in knowledge resource <input type="checkbox"/> Learning ability of actors engaged in logistics-related operations and value-added services <input type="checkbox"/> Perceiving market demand and settled enterprises behaviours <input type="checkbox"/> Corresponding competency and commitment to key stakeholders’ expectations and requirements <input type="checkbox"/> Cohesion ability of divisions of responsibilities in FVs <input type="checkbox"/> Lessons learned from successful FVs <input type="checkbox"/> Initiative in knowing of social responsibility, environmental policy, and sustainability values <input type="checkbox"/> Information and knowledge sharing solutions to FVs operational performance <input type="checkbox"/> Considerations concerning potential investment in eco-friendly equipments and infrastructure <input type="checkbox"/> Provide career training for various divisions in FVs and external entities
Operational process Improvements in technology, core competency, efficiency, and increased productivity; Synergy activities (e.g. consolidated shipments and warehouse) through information exchange
<input type="checkbox"/> Synthetically use and administrate infrastructure <input type="checkbox"/> A combination of information (time, accuracy, and details of contents) during logistics operations <input type="checkbox"/> Rapid response to changing customer requirements <input type="checkbox"/> Application of innovation and new technologies for greening logistics activities <input type="checkbox"/> Consolidated shipment and warehousing collaborated by settled enterprises via information sharing <input type="checkbox"/> Processing technique matched for storage, dispatching, and distribution <input type="checkbox"/> Transportation planning, route optimization, and intermodality of eco-friendly approaches <input type="checkbox"/> Embed logistics operations in supply chain integration <input type="checkbox"/> Involvement in projects or activities resolving urban/industrial problems

Stakeholder relationships
Integrate, balance and satisfy the needs and requirements of FVs key stakeholders; Directly approach to sustainability
<input type="checkbox"/> Trust, preference, long-term order from customers <input type="checkbox"/> Reputation attractiveness for potential customers <input type="checkbox"/> Mutual satisfaction between the management and settled enterprises <input type="checkbox"/> Honours as good partners with urban planning and transport departments <input type="checkbox"/> Affiliate with professional associations, special groups such as Eco-efficiency Centre, NGOs <input type="checkbox"/> Knowledge-based stakeholder engagement activities (see Table 6-9)
Current sustainability level
Mirror current sustainability capability; Will be the feedback also be provided for next KM cycle
<input type="checkbox"/> Economic profitability <input type="checkbox"/> Investors revenue <input type="checkbox"/> Measurement of customer service and productivity <input type="checkbox"/> Job offers inside the FV and potential job creation <input type="checkbox"/> Waste treatment in FV up to the standards of environmental protection sector <input type="checkbox"/> Energy cost saving and the room for improvement <input type="checkbox"/> Calculation and internalization of external costs (e.g. air and noise pollutions, traffic congestion) <input type="checkbox"/> Increased job satisfaction and outputs of the employee <input type="checkbox"/> Active effects on logistics development in regional industries

6.4 Key elements

To increase the effectiveness of the roadmap, three key elements are identified including human ability, stakeholder engagement, and information-based system.

6.4.1 Human ability

From the perspective of BSC or SBSC, a learning-and-growth metric primarily reflects the human ability. It is a framework for assessing and generating employee satisfaction, productivity and retention which is regarded as “the foundation for all strategy” (Kaplan & Norton, 2001). Normally knowledge is acquired and supported in a process of human thinking and man beings are the major repository of knowledge resource. Consequently, human ability is an indispensable element in using the roadmap. It is associated with training and organizational cultural attitudes toward both individual and organizational improvements. Two human groups including logistics practitioners and the FV management are particularly relevant to FV development.

(1) Human ability of logistics practitioners

A logistician is a professional logistics practitioner. Due to the increasing complex mix of logistics services in FVs, the increase of qualified logisticians becomes imperative. Logistics is a broad field comprising procurement, production, distribution and disposal activities, and a new trend of fourth-party logistics-consulting companies. Logisticians are

therefore required to be skilled in three aspects: theory, practice, and implementation. They are named strategic and theoretical logisticians, operative logisticians, and implementing logisticians. Figure 6-7 describes the tasks of logisticians, and relations and tensions between theory, implementation and practice in logistics. Prerequisites for a successful logistician are analytical thinking, open minds, creativity, and judgment. Operative logisticians are required to have higher practical ability especially in test, usage, application, performing, scheduling, etc. Prerequisites to the success for an implementing logistician are constructive thinking, organizational competencies, and a profound knowledge of the possible solutions (Gudehus & Kotzab, 2009). The three parts in the loop support each other with the supply of strategies and methods, installations, experiences, and observations; and the offers of recognitions and ideas, rules and regulations, return and use along with another direction of the cycle.

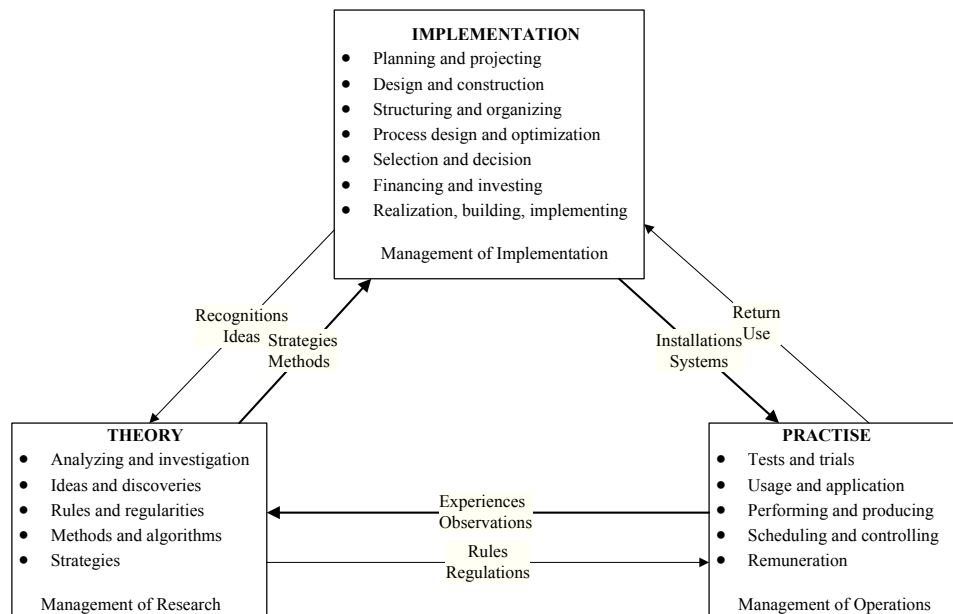


Figure 6-7 Tasks of logisticians and relations

Source: Gudehus & Kotzab (2009).

One of the successful factors for logistics practitioner ability is knowledge producing centres, such as universities, research institutions, consulting firms, and think tanks. The knowledge learning provided by universities is highly relevant to the foundation of logistics practitioners' development and potentials in the logistics field. Clearly, higher education offered by universities is most basic and critical. Tong (2011) proposes a set of teaching methods in managing logistics higher education, including general lecture, "guest" lecture, exercise, individual and group projects, case studies, seminar, internship, excursion, and discussion. According to these teaching methods, extensive theoretical

knowledge and practice skills in the logistics field are expected to be generated, such as theoretical background, up-to-date knowing, interdisciplinary skills, practical knowledge and experience, ability in decision-making and identifying priorities.

Some of the countries with well-performed logistics industry have invested in specialized university facilities and research institutes in support of their logistics missions and upgrading capabilities through partnerships with worldwide institutes/centres of excellence. Singapore is a typical representative; the government attaches great importance to the investment in education and research. Some institutes in the logistics field partner with leading universities for stronger development. For example, the partnerships among the Logistics Institute Asia-Pacific, Nanyang Technical University and Georgia Institute of Technology, and the MIT Singapore represent a logistics-related higher learning collaboration approach.

As well in Germany, the logistics education and related researches offer excellent experiences. There is a variety of independent institutes and faculties in universities specializing in logistics. A good example of interdisciplinary research cluster is the LogDynamics affiliated to the University of Bremen. LogDynamics is a research community focusing on the logistics field characterized by internationalization and interdisciplinary (Rügge & Scholz-Reiter, 2011). Internationalization means that it is a cluster of selected doctoral students from around the world, e.g. Brazil, Canada, China, Egypt, Ethiopia, Germany, Iran, and South Korea. All of these doctoral students come from several different faculties in the University of Bremen. The involved faculties are related to production engineering, computer science, mathematics, physics, electrical engineering, and business economics. This kind of research community is helpful to share knowledge among young researchers from different backgrounds relating the same focus – dynamics in logistics. The education approach like LogDynamics fulfils the increasing requirements for logisticians' comprehensive capability.

(2) Human ability of the FV management

Successful cases evidence the management of a FV supported by an independent company (e.g. FV Management/Development Company) is particularly effective at present. In brief, a series of benefits can be generated by higher level ability of the FV management/development company. First, it can make out synergy potentials and gain cost advantages on behalf of the settled enterprises through initiating cooperation activities. Second, as a service and communication platform, it coordinates the involved

enterprises and external agents to increase knowledge resource pooled in the FV. Table 6-6 reviews two examples including Interporto Bologna and GVZ Bremen regarding their management/development companies' functions.

Table 6-6 Examples of FV management/development companies in practice

FVs	Components	Functions in practice
Interporto Bologna	4 members from the Bologna municipality; 2 members from the Bologna Province; 1 member each from the Chamber of Commerce, Bank institutes, Trenitalia SpA, Association Industriali Bologna, and Association of Bolognese Road Transport (SpA, 2005)	Entrepreneurial activities, terminal management and promotion, real estate, a shunting operator, lending their expertise to the development of other FVs throughout Italy (Higgins & Ferguson, 2011)
GVZ Bremen	FV-members; Private companies (e.g. DB AG - German Railway Company); City of Bremen ($\geq 25\%$) (ISL, 2007)	General management, services, consulting, communication, public relations, projects, workshops, Intermodal Transport Promotion Centre (ISL, 2007)

Implications from the two examples can be concluded as: management/development companies are not only responsible for the real estate aspect (acquisition of new settlers/users) of FVs, but also manage communications and promote cooperation activities. Furthermore, sustainability initiatives are possible to spread to more settled enterprises under the cooperation. For example, in order to improve urban goods delivery, the FV development company of GVZ Bremen (i.e. GVZe) once organized a voluntary cooperation program among some carriers and facility providers. In this program, 9 participated companies consolidated their goods into eco-friendly trucks to deliver goods into/in inner cities. Nevertheless, afterwards it was halted due to the withdrawal of government subsidies from this program (Cerreño, et al., 2008).

From the perspective of KM, this research proposes a hopeful orientation for enhancing the FV management ability drawing on the practical experiences: to act as a knowledge cluster and information/knowledge sharing platform. More specific, firstly, the FV management clusters the knowledge about general administration skills and experiences as well as information about settled enterprises. Secondly, it provides the information relating to FVs situations especially the strengths to potential settlers/users usually by presentations at meetings and participation of trade fairs. Thirdly, it offers knowledge expansion schemes such as organizing staff training and advanced qualification program as well as consultation service for the logistics industry. In addition, the FV management should constantly search new knowledge concerning policies, environmental concepts, and technical skills, so as to integrate them into FVs operations.

Meanwhile, the FV management provides feedback to the investors and public authorities for more financial and policy supports.

6.4.2 Stakeholder engagement

Multi-stakeholder contexts in development involve various actors from national or governmental organizations, international organizations, civil society, and the private sector encompassing various disciplines such as urban development and rural development (Thabrew, et al., 2009). Consequently, stakeholder engagement represents a useful approach to sustainable development due to the involvement of multiple sides for the balanced growth. Constructive stakeholder engagement should be a process of sharing views through genuine dialogue between the stakeholders and the management of the organization or the individual side (Gao & Zhang, 2001).

6.4.2.1 Relevance of stakeholder engagement to sustainability

Stakeholder theory is relevant to more effective management and to a more useful, comprehensive theory of a firm in society. It is intended to “broaden management’s vision of its roles and responsibilities beyond the profit maximization functions to include interests and claims of non-stockholding groups” (Mitchell, et al., 1997). The long-term survival and success of a corporation necessitate multi-stakeholder participation and supports. Table 6-7 provides some statements about the relevance of stakeholder engagement to sustainability. From this, a “dialogue” between the management of a corporation and its stakeholders is necessary (Smith, et al., 2005).

Table 6-7 Stakeholder theory and sustainability

Statements	Selected literature
Promoting the participation of a diverse number of local stakeholders and encouraging learning are crucial to overcome the challenges of stakeholders’ conflicting interests resulting from the complexities of sustainable systems.	(Matos & Silvestre, 2012)
Sustainable master planning requires strengthening multi-stakeholder participation and partnerships, facilitating social learning and more proactive and inclusive engagement.	(Rawson & Hooper, 2012)
The effectiveness of sustainability practices depends on the stakeholder relationships and management.	(Steurer, et al., 2005) (Sachs & Maurer, 2009) (Tencati & Zsolnai, 2009)
External pressures and incentives set by stakeholders is the starting point to influence focal companies to engage in sustainability.	(Seuringa & Müllerb, 2008)
Stakeholder engagement can contribute to sustainable development by driving strategic direction and operational excellence for organizations.	(AccountAbility, 2008) (Perrini & Tencati, 2006)
Corporate sustainability needs businesses to develop and sustain relationships with key stakeholders, and establish a corporate culture “consistent with the concept of sustainable development”	(Welford, 1995)

Stakeholder engagement is defined as “collaborations between investors, state actors and citizens (sometimes represented by NGOs) where different actors share in defining or carrying out the purpose of investment” (Forsyth, 2007). Stakeholder engagement can be traced back to Porter’s Five Forces Model. In the traditional model, five factors interact to determine the nature of competition within an industry, including threat of new entrants to a market, bargaining power of suppliers, bargaining power of customers (“buyers”), threat of substitute products, and degree of competitive rivalry (Porter, 1979). According to this, at least five groups of stakeholders are involved in an industry including new entrants, suppliers, buyers, substitute products, and competitors. In recent years, the social contract as an additional and the sixth force is considered into Porter’s traditional Five Forces Model in response to social responsibility (see Figure 6-8).

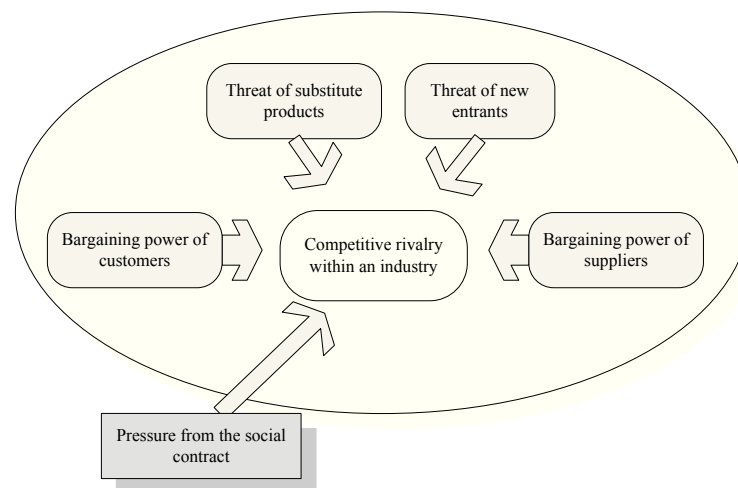


Figure 6-8 Porter’s five forces model plus social contract

Source: Jeffery (2009).

Fineman & Clarke (1996) identify the pressure from “green stakeholders”. Four broad interest sets influence an industry’s responses toward environmental protection:

- Bodies whose manifest mission is to care for the planet
- Regulators
- Those who have an indirect interest in industry’s environmental performance
- Internal stakeholders

Stakeholder engagement brings together a range of expertises, resources and supervisors which can help to reduce experience and technology transfer time and risks in activities towards sustainability. In particular, political parties and the affiliation of stakeholders with (different) political parties can assist in creating broad supports for environmentally sound technologies (Morsink, et al., 2011).

6.4.2.2 Relations among KM, stakeholders engagement, and sustainability

Based on the above analysis, this research explores the relations among KM, stakeholder engagement, and sustainability (see Figure 6-9). In brief, both “knowledge/KM-based view” and “stakeholder engagement” are facilitators for sustainability performance respectively by roles as “engine” and “sufficient conditions”. Stakeholder engagement is indispensable in reaction to CSR and achieving the triple bottom line requirements. If stakeholder considerations seek to include the intersection of business, ecological environment and society, the values generated by stakeholder engagement will meet the requirement of sustainable development (Lorne & Dilling, 2012). In addition, to find out what social and environmental issues matter most to their performance, companies trend to engage their stakeholders in dialogue. This would be helpful for improving their decision-making and accountability (Wikipedia, 2013b). KM provides such opportunities for the dialogue with multi-stakeholder by insights presenting, accessing, exchange, acceptance, which are embedded in their participation. Ayuso, et al. (2006) argue that the existing research “has not dealt with knowledge integration from stakeholders in the context of sustainable development.” Moreover, they also suggest that in order to benefit from “stakeholder capital”, knowledge can be an essential resource in building their relationships.

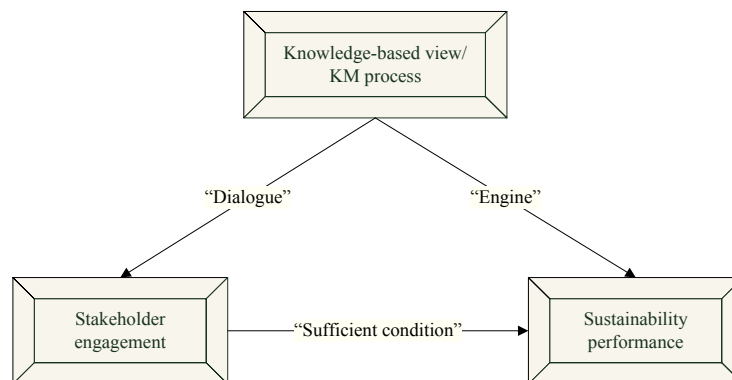


Figure 6-9 Linkages among KM, stakeholder engagement, and sustainability performance

According to these interactive relationships, the sustainability-oriented value of FVs is generated by such actions of KM:

- Acquire and communicate stakeholder requirements (especially suppliers and customers) for improved decision making in further steps;
- Facilitate well knowing of demands and other related information of FV-connected industries to reduce social logistics cost with joint effort, likely by establishing a

transparent trade market and convenient communicating space;

- Provide available policies and regulations, as well as strengthen the social education in driving the sustainability awareness of FVs operators;
- Experiences and skills of well-performed logistics companies is probably pooled in FV management companies/associations, through the knowledge sharing platform, the pooled knowledge is lent to especially small and mid-scale 3PLs for the growth.

(1) Stakeholder needs and contributions

The key stakeholders' identification, their needs and contributions are summarized in Table 6-8. The objective of stakeholder identification makes for a foundation of stakeholder relationship of a FV. They are identified and grouped according to the categories including primary stakeholders, correlative stakeholders, and influential stakeholders. In addition, stakeholder relationship is established on the well knowing of their needs and contributions. FVs operations should consider the needs or expectations of their stakeholders. Contributions of such stakeholders provide tangible and intangible resources for the value realization of FVs.

Table 6-8 FVs stakeholder identification, needs, and contributions

Primary stakeholders	Needs	Contributions
Investors and owners	Revenue and reward	Funds and resource provision
Settled companies	Facilities, reduction in cost and risk	Various services in FVs
FV management company	Profits, success, rewards	Trustee, marketing, development
Managers	Funds, achievability, sustainable competitive advantage	General administration, enabling cooperation, as operators, consultation, sustainability check
Employee	Purpose, care, pay, education, welfare	Hands, hearts, minds, voices

Correlative stakeholders	Needs	Contributions
Customers	Rapid response, fast and cost-effective services, order fulfilment performance	Loyalty, profit, growth
Other FVs	Learning, experience sharing	Benchmarking, network building
Industries	Logistics services, backbone	Profit sources
Public transport authorities	Improvement of logistics sector, realization of development situations	Assisting in planning FVs and transport modes connections
Other transport actors	Integrated transportation by a transport networking	Route optimization, shipping transfer, cooperation
Nearby residents	Life convenience, non-disturbance	Labour, appeal, reminding
Natural environment	More concerns, fewer externalities	Monitoring, early warning

Influential stakeholders	Needs	Contributions
Promotion offices (e.g. Chamber of commerce)	Commitment and cooperation of transport service providers, regional economic growth	Advise, mediate, promoting cooperation
National government	Logistics costs reduction, smooth traffic, people satisfaction	Regulations, master plan, entire allocation, guidelines, subsidization, loan guarantee
Local authorities	Revenue, public service functions, urban consolidation and distribution	Assistance, land and funds provision, specific scheme and coordination
Professional associations	Feedback, practical cases	Projects, organization, training, normal standards, evaluation and sustainability auditing
Special interest groups	Eco-friendly FVs, social responsibilities of FVs	Supervision, warning, public opinion expression
Universities and research institutes	Outcomes examining, value of achievements in science and research	Research projects, technical supports, advice and solutions

(2) Knowledge-based stakeholder engagement

According to the different stakeholders' needs and contributions orienting FVs sustainability, this research proposes a range of knowledge-based stakeholder engagement activities as shown in Table 6-9. These engagement activities are conducted by varying knowledge-based approaches including knowledge acquisition, sharing, utilization. For example, communication, discussion, meeting, training are the different knowledge sharing ways; questionnaire, survey, obtain statistical data can be knowledge acquisition ways.

Table 6-9 Knowledge-based stakeholder engagement activities of FVs

Primary stakeholders	Engagement activities
Investors and owners	<ul style="list-style-type: none"> - Communicate with the financial committee - Report and plan financial affairs - Discuss expansion program
Settled companies	<ul style="list-style-type: none"> - Collect suggestions from settled companies on the overall strategy - Holding companies meetings - Know about requirements and considering them into next scheme - Coordinate settled companies for eco-friendly operating - As representatives of the supervisory board
FV management company	<ul style="list-style-type: none"> - Co-design structure and offer jobs - Response to the feedback from settled companies
Managers	<ul style="list-style-type: none"> - Communicate with stakeholders - FV sustainability report (at regular period) - Organize staff training and advanced qualification program - Promote cooperative services
Employee	<ul style="list-style-type: none"> - Satisfactory survey concerning the salary, the value of self-realization, work environment, security - Employee questionnaire about the sustainability report

Correlative stakeholders	Engagement activities
Customers	<ul style="list-style-type: none"> - Analysis of suppliers/customers needs - Supplier/customers satisfaction survey concerning the logistics services - Research on customers satisfactory during after-sale phase - Focus group with consumer associations - Promote publicity towards potential customers
Other FVs	<ul style="list-style-type: none"> - Exchange visitors for direct communicating - Establish virtual network for mutual learning and training
Industries	<ul style="list-style-type: none"> - Interact via industrial exhibitions - Contact industrial companies face to face - Convey the information of the industry to most settled companies in FVs - Offer consultancies to the industry about logistics activities
Public transport authorities	<ul style="list-style-type: none"> - Discuss panels, direct interactions - As representatives in the supervisory board - Consulting for traffic route optimization - Learning regulations and laws on traffic issues - Signing cooperation deals
Other transport actors	<ul style="list-style-type: none"> - Seek cooperation opportunities in transport chains to save deliver time, cost - Ding research projects
Nearby residents	<ul style="list-style-type: none"> - Satisfaction survey about their living environment - Offer seminars to spread scientific knowledge about FVs - Invite residents to visit FVs
Natural environment	<ul style="list-style-type: none"> - Regard the natural environment as an essential stakeholder; - Obtain statistical data of CO₂ emission

Influential stakeholders	Engagement activities
Promotion offices (e.g. Chamber of commerce)	<ul style="list-style-type: none"> - Deliver reports to promotion offices involving performance evaluation - Ask for assistance in case of financial shortage or expansion construction - Participate in the events organized by promotion offices
National government	<ul style="list-style-type: none"> - Work out the master plan for country-wide traffic/logistics - Establish supportive policy for FV development - Integrate FV projects into public infrastructure facilities
Local authorities	<ul style="list-style-type: none"> - Feasibility study of the proposed FV projects - Assist national government in executing strategies - Integrate FV projects into urban planning - Participate in constructing and managing FVs
Professional associations	<ul style="list-style-type: none"> - Assess the performance of multiple FVs - Edit and publish books and reports about FV developments - Sustainability performance survey on FVs and additional suggestions - Organize conferences and workshops for the discussion about FVs - Offer consultation services
Special interest groups	<ul style="list-style-type: none"> - Attach the importance to their counsels - Expose facts to special interest groups - Open communications
Universities/research institutes	<ul style="list-style-type: none"> - Involve universities/research institutes into cooperation projects - Enhance communication and cooperation for logistician education - Establish online campus offering e-learning platform
Experts	<ul style="list-style-type: none"> - As representatives in the supervisory board

6.4.3 Information system

Nowadays, FVs are in the race for the competitiveness in order to compete in the dynamic logistics market. The competitiveness of FVs increasingly relies on the information system during the operation. In a word, an information system uses computer science (i.e. information and communication technology) to serve business. Regarding the logistics field, the core functions of information system include information management related activities such as order fulfilment, storage management and control, shipment scheduling, package tracking, e-commerce services, and distribution management. Information infrastructure is used to directly disseminate relevant market information throughout a FV, so as to avoid a loss of time and cost, as well as improve competitive advantage.

This research will explore two forms of information systems associated with FVs:

(1) Integrated information system

As an overall information system in FVs, it can realize comprehensive information-related operations. An example of Zhejiang Transfer FV (in Zhejiang province, China) will be provided to describe how it works. In this case, owing to an integrated information system, significant reductions in social logistics cost, operating time, and CO₂ emission are generated.

(2) Special information system for a certain function

Any function in FVs may be equipped with a specific information system to adapt to its own tasks. This research takes intermodal transport as a research point, as central to a FV is an intermodal terminal connecting major freight corridors. It is a responsible choice toward a growth model complying with environmental sustainability issues. Because of the distributed nature of the actors and knowledge resources involved in the intermodal transport, the need for appropriate knowledge sharing tools becomes imperative. A conceptual model of knowledge sharing platform will be proposed from a multi agent-based perspective.

6.4.3.1 Case study of integrated information system within FV: Zhejiang Transfer FV

The project c of Zhejiang Transfer FV covers 37.3 ha land with a total investment of 300 million CNY. The site features a connection to the Hangzhou City (Zhejiang's capital city) with 15 minutes' driving distance and a direct access to the Xiaoshan Economic and Technological Development Zone. It is located on the southern bank of QiangTang River within the Yangtze River Delta along the Southeast coast. This FV connects to several major highways and an airport such as Shanghai-Hangzhou-Ningbo Highway and

Hangzhou-Jinhua-Quzhou Highway, and Hangzhou Xiaoshan International Airport which is 10 km away. It is also 170 km from Shanghai Port and 130 km from Ningbo-Zhoushan Port, both of which are the two largest seaports in China.

The Transfer FV located in Zhejiang province represents a good example of a privately financed logistics cluster that has gradually evolved to a large scale FV based on efficient information system. Its business plan mainly includes integrated logistics-oriented activities. Zhejiang Transfer FV is anchored by the “Transfer Group” which is a private enterprise group engaged in a variety of businesses covering chemicals, logistics, agriculture, tech city, and investment. Before launching this FV, Transfer Group had successfully reformed and upgraded its previous self-using truck services provision to today’s construction and operation of logistics clusters. The Zhejiang Transfer FV project has been put in use since April 2003 with an initial purpose of breaking a new ground for China’s road transport. Road transport is the most important transport mode undertaking the vast majority of logistics tasks within China. However, the road transport in China has been facing a series of fragmented and energy-inefficient situations, which limit the whole country’s logistics efficiency. In view of this, Zhejiang Transfer FV is pioneering in integrating individual elements into synergy of logistics chains in China. Apart from the traditional logistics facilities and basic services, its information service focusing on the road transport is greatly contributed.

Main functionalities of this FV include information, trade, transportation, storage, distribution and transshipment. The information centre offers information services relating to storage, trade, and transportation for settled companies. It also guides these tenant companies to operate with modern technologies and management in terms of business process, data security, and transmission, so as to strength their service capability and reduce operating costs. In addition, the seamless docking of cargo and carrier is able to be realized by its information integration capability. The information centre enables Zhejiang Transfer FV to acquire, process, and share vast quantities of logistics-related information about goods, customers, haulage vehicles, and logistics facilities, etc. The information centre disseminates more than 7000 pieces of information from 30,000 industrial and commercial enterprises daily. Therefore, long-haul truck drivers are able to find the cargo which will be freighted along the same route with their return journey. This can lead to a considerable reduction in the empty running.

The trade centre accommodates more than 480 users of 3PLs in transportation, storage, less-than-truckload freight, freight forwarding. Operations of cargo trade, trucks

and storage take place in the trade centre.

The transportation centre provides a networking platform daily serving 400,000 external trucks and 3000 vehicles. More than 100 special freight lines linking Hangzhou city and other places of China for the less-than-carload freight are established. The inside parking space is about 8.7 ha.

The storage centre features 8 ha warehouse and 1 ha less-than-truckload warehouse. Besides, the personalized customization and specialized storage services are included. The distribution centre provides integrated logistics service for chain stores and other kinds of markets, ranging from wholesale to dispatch, storage, and transportation. The competitive advantage of transshipment centre is the three-dimensional traffic location with a nexus of sea, road, and rail. Thus the service pattern of a combination of road, rail and water transport is formed.

Figure 6-10 outlines the information system structure of Zhejiang Transfer FV. It mainly consists of four application systems for logistics, three basic platforms, two support systems, and a logistics e-commerce portal.

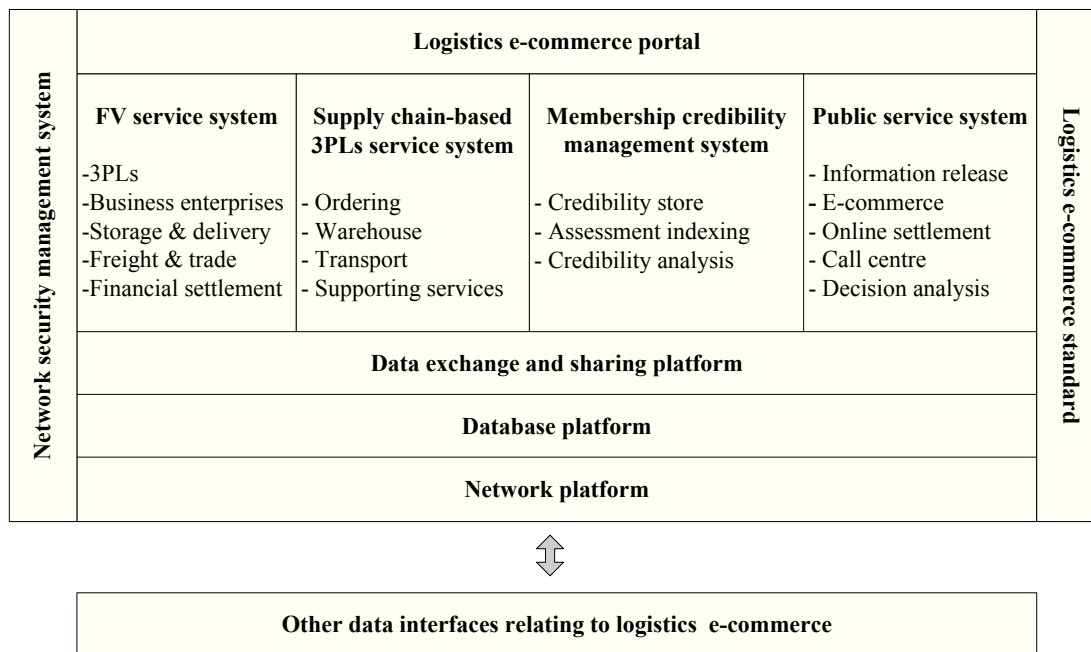


Figure 6-10 Information system of Zhejiang Transfer FV

The application systems include FV service system, supply chain-based 3PLs service system, membership credibility management system and public service system. FV service system strengthens the cooperation between the FV and its relevant enterprises such as 3PLs and business enterprises as well as improves the service quality. Through

the information-based cooperation, one-stop logistics services and customized services are available, e.g. storage, delivery, freight, trade, financial settlement.

Supply chain-based 3PLs service system assists 3PLs to improve their information management levels and competitive advantages. This brings the transformation to supply chain-based logistics operations for 3PLs.

Membership credibility management system establishes the files relating to the membership credibility through credit evaluation. Based on the membership, three evaluation methods are included: self-evaluation, evaluation from professional associations, and evaluation from the third-party. According to this, a driver can apply to be a creditable freight provider for better competitiveness, and meanwhile, the credit information of the carriers (i.e. drivers) is offered for shippers.

The public service system represents a comprehensive network where stakeholders can release and inquiry information for their operations. Basically it includes information release, e-commerce, online settlement, call centre, and decision analysis. Through the public service system, the real-time communication especially between shippers and carriers can be realized. They also can close deals efficiently.

Three basic platforms involve network platform, database platform, as well as data exchange and sharing platform. On the basis of local area network (LAN), the network platform connects Intranet within the FV and Extranet by the Internet. It connects public wireless network, mobile devices such as mobile phones and PDA. The database platform is founded on a large relational database comprising 3PLs databases, business enterprises database, transaction database, comprehensive database, etc. The data exchange and sharing platform leads to the data and information sharing: among multiple internal information systems; between information systems and the FV e-commerce portal; between FV and external information system such as e-government system. In addition, a set of standards, efficient and secure information sharing mechanism is particularly relevant to such interactions.

Two support systems include logistics e-commerce standard system and network security management system. The former establishes a range of standards relating to data sharing, logistics operations, and customer services. It facilitates various logistics agents to be organically linked throughout the whole operational management process. The network security management system contains both security management technologies and regulations, which offers a guarantee of confidentiality and reliability.

Relying on the systems mentioned above, the logistics e-commerce portal creates

opportunities of direct dialogue between demanders and suppliers by offering a range of services openly. Logistics services involve information giving, freight tracking, carriers' validation, consulting, looking for suppliers, and other logistics-related services, etc.

The innovative establishment of this information system has generated a significant reduction especially in empty-load running. It brings about 40% savings of logistics cost comparing the traditional ways. The transport efficiency has been largely improved though logistics outsourcing. For example, the previous journey from Hangzhou to Beijing and Tianjin usually took 5-6 days, while now the cargo freight can arrive within 1 day. The most compelling outcome of the Zhejiang Transfer FV project is a reduction of 140,000 tons of CO₂ emission per year due to the information-enabled logistics activities. Moreover, the information system has lead to the logistics integration for manufacturing firms. It generates the growth of a large number of 3PLs and their information system upgrading.

6.4.3.2 Knowledge sharing in intermodal transport: a multi-agent based perspective

Intermodal transport is a typical mode characterized by a multiplicity of players. It covers a wide range of transport activities supported by operators of local road haulage, rail, sea or inland waterway, and other independent organizations. The integration of multiple transport modes requires a process or system approach for execution and “a higher degree of skills and broader knowledge of the transportation/supply chain processes... equipments, and infrastructures” (Muller, 1999). Because of the distributed nature of actors and information resources involved in multi-organizations, the need for knowledge sharing among actors seems imperative. As it moves from a focus on infrastructure components to a holistic focus on processes or systems, knowledge constitutes a valuable intangible asset for sustaining competitive processes and systems in today's global economy. The success of intermodal transport depends largely on the knowledge sharing between multiple players. Knowledge sharing leads to seeking more effective ways to exchange knowledge among people, so as to enhance competitive capabilities and respond better to business opportunities (P. Liu, et al., 2011).

The motivation of establishing a communication platform for intermodal transport stems from a lack of tools to ensure up-to-date information sharing. Examples of the information are position of freight and vehicles, expected arrival and waiting times as well as alternative routes and transport modes (Bernaer, et al., 2006). The increasing use of multi-agent system (MAS) provides a significant opportunity for the transport sector.

For example, a MAS is capable to make route planning and vehicle allocation in real time considering the challenges in a city logistics. Thus the changing customer order data and vehicle conditions can be incorporated dynamically (H.-D. Haasis, et al., 2009). It also has the potential to improve the quality of intermodal transport by linking numerous participates. MAS enables qualified information to be more smoothly shared among the actors, which could bring about collaborative efficiency. The collaborative efficiency supports the fulfilment in terms of production, infrastructure, technology, quality, and policies making in intermodal transport.

The operation of intermodal transport is usually conducted by independent actors. These may be: the demand side (shippers, forwarders, ocean shipping lines, logistics service providers), the supply side (infrastructure providers, transport and intermodal transport operator), the policy side (authorities, regulators, associations) and the surrounding side (quarantine and inspection, customs, insurance and bank) (Vrenken, et al., 2005).

One of the primary challenges in intermodal transport management is to coordinate both several inter-dependent activities and the communication between the multiple actors (Davidsson, et al., 2005). Therefore, the concept of knowledge sharing is required. Knowledge sharing is the act of not only contributing one's own knowledge but also seeking and receiving others' knowledge within a system. It retrieves the existing organizational knowledge and exchanges the existing personal knowledge as well as generates new knowledge. The knowledge can be represented with the usage of specific data structures in established computerized knowledge base. Consequently, this can reduce errors, enhance the quality of cooperation, and make it possible to monitor intermodal transport chain.

Agent technology is an appropriate approach to design and develop a distributed system for knowledge sharing (VanElst, et al., 2007). An agent is used to denote "hardware or (more usually) software based computer system that owns one or more of the following properties: autonomy, social ability, reactivity, pro-activeness, cooperation, learning, mobility and communication" (Wooldridge & Jennings, 1995). Due to the limitations of system resources and the skills of the agent itself, the tasks undertaken by a single agent are very limited. In contrast, MAS is a group of agents which works as a single system to undertake large and complex tasks by integrated functions. MAS offers a new dimension for cooperation and coordination in distributed collaborative environments, also provide an effective approach to help the members of a system to

share their knowledge (C. Zhang, et al., 2008). Intermodal transport is characterized by a distributed collaborative environment, thus this research explores its knowledge sharing from a multi-agent based perspective.

Multi-agent based knowledge sharing platform

Knowledge sharing platform (KSP) builds a network for intermodal transport players, thereby gaining more efficiencies and sustainability. A multi-agent based knowledge sharing platform called MA-KSP is a collection of agents cooperating with each other, which enables the fulfilment of knowledge sharing missions - retrieval, exchange and creation of knowledge.

Starting with an introduction of the basic agent within MA-KSP, and then an overview of knowledge content for practical using is provided. Subsequently, a multi-agent based architecture for KSP is depicted in the context of intermodal transport, with the details about the constituent agents and their interactive behaviours.

Basic agent

In essence, agent is an entity that performs autonomous actions based on information; it may rely on other agents to acquire or share information to achieve its goals. In principle, an agent on a level is able to access all information from other agents linked to it (Lefebvre, 2003).

The abstract structure of a basic agent in MA-KSP is depicted in Figure 6-11. In this research, each agent has its own objectives in sharing knowledge. Moreover, the term “agent” will be used to modules that are autonomous, interactive, learning, and have the ability to communicate over a network (Wooldridge & Jennings, 1995):

- Autonomous: “operate without direct intervention of humans or others, and have some kind of control over their actions and internal states”
- Interactive: “the capability of interacting with other agents and possible humans via an agent-communication language”
- Learning: “the ability to learn while acting and reacting in its environment”
- Communication: “the ability to exchange information between disparate entities. This information exchange could be as simple as a trip signal, or could be complex such as detailed information about a remote location”

In order to make knowledge available to others and absorb the right knowledge, agents of MA-KSP perceive their environments through sensors and act upon their environment through actuators. Their environment consists of other agents and various

knowledge flows. In intermodal transport, sensors inputs may include impact factors (such as cost, transit time, reliability, and provided services), online operating data, transportation monitoring, etc. Examples of actuators outputs are strategic and tactical planning, decisions, selection of transport modes, and operational control.

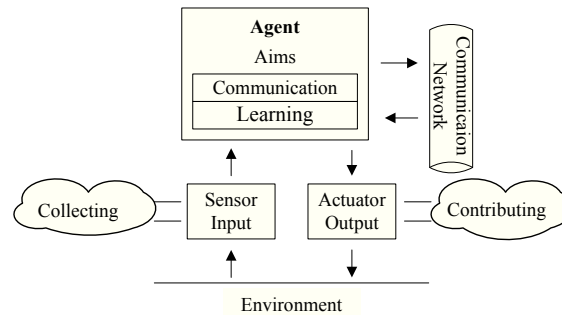


Figure 6-11 Abstract structure of agents in MA-KSP

An overview of knowledge content

An understanding of knowledge content embedded in intermodal transport enables the design and use of MA-KSP. Considering the professional activities and their objectives in intermodal transport, Table 6-10 provides an overview of knowledge content involved in MA-KSP. In line with the logistics service requirements and intermodal transport characteristics, the involved knowledge is related to time, cost, reliability, flexibility, and legitimization. Corresponding items are listed following these dimensions showing the knowledge flow sources concerning intermodal transport.

Table 6-10 Knowledge content in intermodal transport

Orientations	Knowledge items	
Time		<ul style="list-style-type: none"> - Technical speeds of different traffic modes - Limitations of infrastructure capacity, and legal capacity to these speeds - Route distance impact on the reliability of different traffic modes - Extra handling time (transfer of loading units between modes, services or players) - Scheduled time table
Cost		<ul style="list-style-type: none"> - Budget of total costs - Prices of different transport means and infrastructure - Indemnity agreement on loss or damage insurance - Intangible costs (disturbance to ecosystem, obtrusive to human communities) - Invoicing issues
Reliability	Matched capacity	<ul style="list-style-type: none"> - Analysis and assessment of potential tasks - Route choices at the planning phase - Simulation and prognosis of the needed transport capacities - Adaptability to the operation environment
	Punctuality	<ul style="list-style-type: none"> - Percentage of shipments arriving late - Degree of delay
	Security and safety	<ul style="list-style-type: none"> - Awareness of safety issues - Safety quality of candidates - Solutions for loss and damage control - Causes of damages
Flexibility		<ul style="list-style-type: none"> - Requirements and conditions on dangerous goods shipping - Changing circumstance and disturbances (e.g. natural disasters, war, strike) - List of circumstances which would require using alternate traffic modes
Legitimization		<ul style="list-style-type: none"> - Border procedures (customs inspections, official quarantines) - Current situation and trend of related laws and regulations

Architecture of MA-KSP

The architecture of MA-KSP is designed as Figure 6-12. It describes different agent types and their functions in the KSP. These agents are identified by their own special tasks: resource store, communicating facilitator, and functional work.

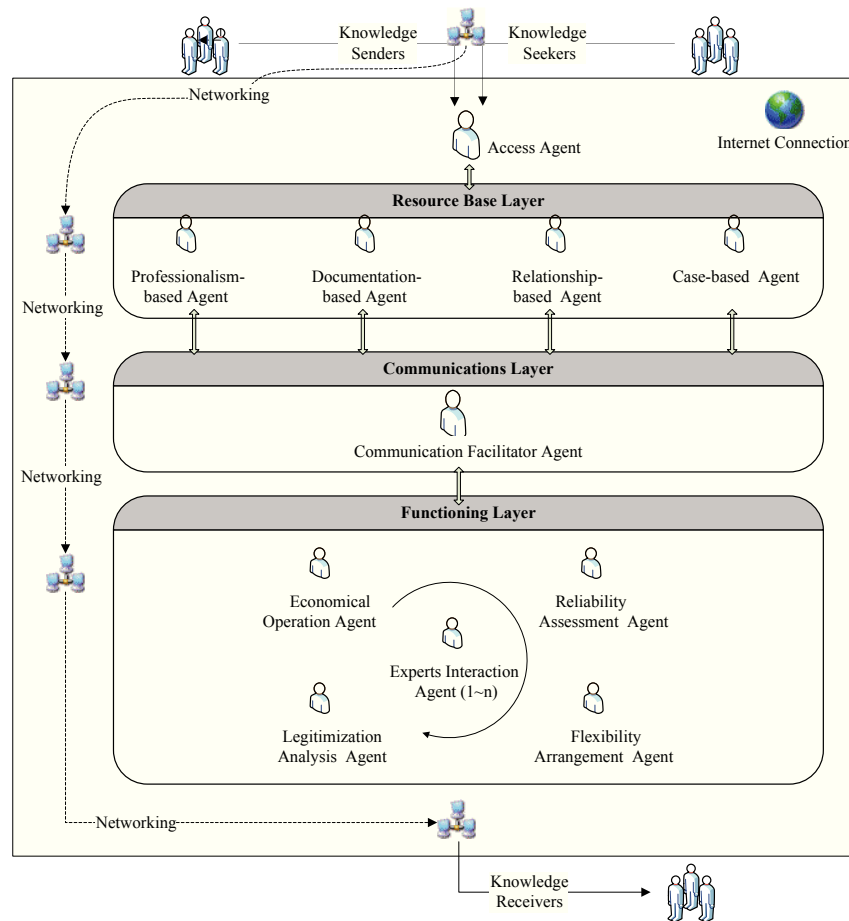


Figure 6-12 Architecture of MA-KSP for intermodal transport

These distributed agents communicate and perform the tasks of knowledge sharing under a computer networking. Any agent holds its own “background knowledge base”, “data base”, “model base”, and “case base”. In detail, background knowledge is especially crucial for intelligent decisions, which can be acquired from experts’ experiences. Moreover, models and algorithms bases offer the sources for quantitative analysis, which rely on the improvement of computing technologies in the field of transport controlling. In the process, the learning module of each agent conducts continual experience review, information collection, data mining, and knowledge discovery. Consequently, new knowledge will be added into the knowledge base, meanwhile the mode base and case base are both updated, resulting in improved abilities to adapt to a dynamic environment.

Any actor in intermodal transport could be a promoter driving activities of knowledge sharing. In general, they can be classified into three roles: knowledge senders, seekers, and receivers.

This architecture contains four types of agents at three layers. Their responsibilities

and interactive behaviours are detailed in the following.

- Access agent examines the entered knowledge

The access agent ensures the security of the entered knowledge through browsing and identification via networking. The access agent can do in two ways. First, several pages of information could be browsed ahead in the background. Second, possible interesting pages from those browsed would be identified then presented to other agents (Kerckhoffs & Vangheluwe, 1996).

Access agent scans the information mainly from knowledge senders and knowledge seekers. On one hand, since an individual sender's type is unobservable to the receiver, normally there is no mechanism for a sender to credibly communicate the value of his knowledge to the receiver. Hence, before reusing or creating knowledge, access agent should confirm the knowledge provided by senders that are not-repeated or updated. Then, the qualified knowledge is generated for storing or processing in next steps. On the other hand, facing various requests from knowledge seekers, the assess agent should ensure that such requests are potentially contributed or can be addressed currently.

- Resource-based agents provide and assimilate knowledge

Then the permitted knowledge (knowledge sent or requests) move toward the resource-based layer. Agents at the resource-based layer can not only provide existing knowledge resources for the seekers' requests, but also selectively assimilate the knowledge provided by the senders. Four agents are identified including professionalism-based agent, documentation-based agent, relationship-based agent, and case-based agent. Professionalism-based agent administrates the tacit knowledge attributed to a professional field, such as enterprise spirit, professions code, professional ethics, and creativity, etc. Documentation-based agent holds the knowledge concerning address lists, documented manuals, project reports, knowledge maps. Relationship-based agent manages mechanisms of stakeholder relationships in the form of roles definition and actors' interactions. Case-based agent relates to cases storage and it offers adaptive solutions to different problems. Such solutions can be either set in advance, or obtained from the problem solving process. Only agreed excellent solutions can be added in the case base.

- Communication facilitator agents connect and coordinate work

A special group of agents called communication facilitator agent (CFA), who are broker agents functioning in two folds: (i) they constitute a communication platform linking the resource base layer and the functioning layer, and they are responsible for

resource allocation in the MA-KSP, (ii) CFA coordinates the interactions between agents. They scan and acquire knowledge from other agents or existing knowledge base. Examples include the “Terminal Checker Agent” and the “Transport Checker Agent”. One agent can contact other agents to acquire knowledge about terminal suppliers or transport suppliers. Behind the scenes the CFA comb the requested knowledge to make a standardized outcome.

- Functioning agents process unusable knowledge

Unusable knowledge at previous layers will be processed in the functioning layer. The four basic functioning agents (Economical Operation Agent, Reliability Assessment Agent, Flexibility Arrangement Agent, and Legitimization Analysis Agent) are designed considering the effects of intermodal transport. Each of them is responsible for special issues and proposes opinions from its own view. Economical Operation Agent (EOA) processes information relating to systematic economical efficiency, loss or damage, arriving time, etc. It offers suggestions and solutions on how to reduce loss and enhance transport efficiency. For this, EOA uses corresponding models, algorithm (e.g. modes connecting planning, vehicle load forecast, energy consumption planning, storage turnover planning) and strategies of economical concerns. Reliability Assessment Agent (RAA) offers real-time assessment on reliability of intermodal transport. Similarly, RAA uses corresponding models, algorithm (e.g. transport capacities simulation, delay degree prognosis), and related knowledge. In actual practice, they put forward “suffering forecast” and normally report the bottlenecks of intermodal transport. Flexibility Arrangement Agent (FAA) deals with emergency situations. Once it receives the request of solving emergency, FAA endeavours to find out the location and cause of the emergent problems as well as offers solutions. Legitimization Analysis Agent (LAA) is responsible for the counselling knowledge about laws, policies, and regulations. LAA offers suggestions on legal feasibility and keeps tracking on legal status as well as issues concerning intermodal transport.

Expert Interaction Agents (EIAs) (1~n) generate solutions in integrated manner - negotiation on the opinions of basic functioning agents. Usually they not only guide the work of other functioning agents, but also offer a final answer to the knowledge receivers through negotiations.

Example

In order to explain how the MA-KSP works in practical application, an example using MA-KSP in intermodal transport is provided.

Figure 6-13 outlines a real-world scenario in intermodal transport using MA-KSP. This example relates an Intermodal Operator' activities in the initial phase of intermodal transport.

MA-KSP serves the knowledge seeker (i.e. intermodal operator) for reusing and creating new knowledge, thereby making an optimal plan. In general sense, an intermodal operator is anyone who undertakes the arrangement for a transport of goods using more than one mode of transport and who issues one transport document for the entire cargo journey. This often refers to door to door transport (Roemer, 2011). They coordinate fragmented activities in this transport chain, procure transport and transshipment services and take over commercial risks.

Besides, “knowledge senders” such as transport operators, facility operators, public authorities, and insurance company send their knowledge in various forms into the KSP. They not only supply for the resource-based agents, but also participate in the negotiation section. Knowledge can be directly used from the resource-based layer to avoid unnecessary exchanges of related messages. Otherwise, the KSP make them clear or systematic through negotiation of functioning agents.

At the beginning, facing an opportunity, the knowledge seeker proposes a series of questions, e.g. whether it is worth accepting the intermodal transport offer? How to select transport modes? What are the legal and administrative procedures? Which is the best route? In order to seek the answers, the knowledge seeker requests the access agent for permission. After the verification of identities, resource-based agents retrieve in their knowledge base, try to abstract matched knowledge for the answers. If the current questions can be answered (“yes”) in this phase, that will mean “one-way” approach for knowledge sharing, which mainly reflects the process of knowledge reusing. In detail, the intermodal operator obtains clear knowledge from these resource-based agents in such ways: similar or same cases store tells the intermodal operator the value of undertaking this task or the reason of giving up; existing documentation offers the selection of traffic modes or a complete transport route; professionalism-based and relationship-based agent provide knowledge about corresponding legal and administrative procedures, as well as responsibilities of a intermodal operator in this task. These compose a definite answer to

the request. During the knowledge abstracting and reusing process, experience learning is viewed as a leading role.

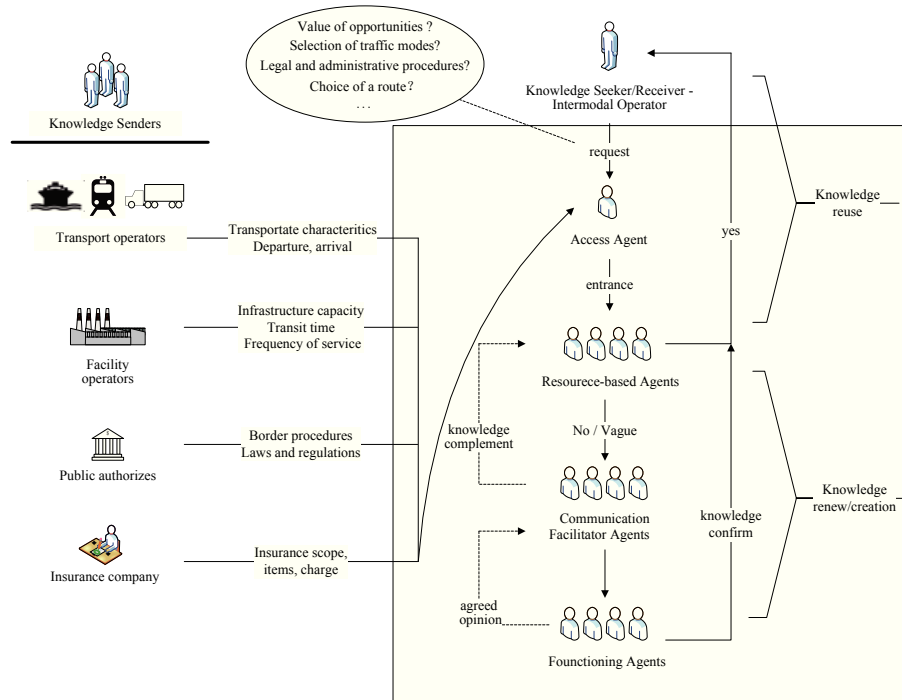


Figure 6-13 A scenario of using MA-KSP in intermodal transport

If the resource-based agents cannot offer matched knowledge or the answer is vague, the following section (knowledge renew/creation) of knowledge sharing will occur. It is an interactive negotiation process involving multiple functioning agents. Functioning agents analyse knowledge backgrounds of involved knowledge senders, and also engage in predictive parsing and analog simulations. The whole depends on the information offered by authorized knowledge senders, the ability of functioning agents, and their communication and negotiation skills. Usually authorized knowledge senders in this scenario are the potential cooperative partners for freight forwarders, thus their knowledge sent to the KSP are helpful. The knowledge scope ranges from transport operators conditions (such as transport characteristics, departure, and arrival) to facility ability (infrastructure capacity, transit time, frequency of services). In addition, it covers border procedures of possible routes, related laws and regulations, insurance scope, items, charge of possible insurance companies. Functioning agents respectively work out their own optimal solutions, and present their attitudes to other agents. Considering the suggested optimal solutions and assessment opinions, expert interaction agents give confirmed answers through their negotiation concerning: acceptance or rejection of the potential intermodal transport task, choice of transport modes, arrangement of transmit

nodes, plan of the freight route, preparation for the administrative affairs, and insurance choice. Meanwhile, the agreed opinion can be used by resource-based agents to amend their knowledge bases.

A great many scenarios in intermodal transport need the MA-KSP to smooth knowledge sharing channels, e.g. organizing a freight transport, dealing with contract problems, addressing the delay of arrival time. In addition, a most important factor is the active contribution from knowledge senders (they can provide quantifiable and live information). In the interaction context, the roles of knowledge seeker, sender and receiver are often changing. Even in one scenario, one actor can play more than one roles in the process of knowledge sharing.

6.5 Summary

This chapter starts with an analysis of KM characteristics in the areas of logistics, supply chain, and FV. Then how the general KM process (knowledge acquisition, sharing, and utilization) act on sustainable FVs is clarified. In which, the sustainability-related stakeholders of FVs are identified. Furthermore, it proposes a roadmap of organizing KM for sustainable FVs considering the distinct features of KM in the FV context. The roadmap is structured by social foundation layer, functioning layer, and auditing layer.

Besides, a checklist for building FV sustainability capability based on SBSC is provided, which is hopefully being the guidance for FV operators and decision makers. To support the success of this roadmap, three key elements are identified including human ability, stakeholder engagement, and information system. Human ability focuses on the logistics practitioners and the FV management. FV stakeholders' identification, their needs and contributions, and knowledge-based stakeholder engagement activities are analysed. The example of Zhejiang Transfer FV and a conceptual MS-KSP framework are explored concerning the information system.

CHAPTER 7

Applicability of freight villages in agricultural products logistics

This chapter focuses on the applicability of FVs in agricultural products logistics (APL) in China. It integrates a range of topics studied in the previous chapters: FVs functions especially the contribution to urban consolidation and the intensive provision of logistics services, twofold nature of FVs and the leverage for sustainability, status quo of China's logistics sector and the directions for FV development, KM approaches to the planning stage and sustainability performance of FVs.

APL is linked to the movement of agricultural products (agri-products) promoted by some in agriculture, logistics service, food sales and service. Employing over 300 million farmers, agriculture has been a country-level strategic industry in China. Current Chinese APL development is facing low efficiency, high post-harvest losses, and a lag in information system. In addition, frequent deliveries of agri-products into/within urban areas result in traffic congestion and air pollution, which greatly affect the social sustainability. To cope with such situations, this chapter proposes an integrated logistics solution involving FVs toward the sustainability of APL for the balanced benefits of farmers, consumers, and city life.

In order to construct appropriate agri-FV projects and strengthen the sustainability performance of APL, this chapter adopts KM approaches discussed in chapter 5 and chapter 6 are adopted for agri-FV projects' planning and operations.

7.1 Agricultural products logistics development in China

7.1.1 APL in concept

APL is concerned with the storage, processing, movements, and information relating to agri-products after harvest. It links the production and the consumption in support of activities "from production to distribution that bring agricultural or horticultural products from the farm to the table (Aramyan, et al., 2006)". In general, the value proposition of APL lies in four aspects: (i) realize the value and use value of agri-products; (ii) enable value added benefits during logistics process, (iii) coordinate production and distribution, (iv) information flow of APL integrates the whole supply chain so as to improve its

market response.

Nevertheless, there are a number of challenges and obstacles that APL faces. On the one hand, the fragmentation and a lack of coordination between APL processes may result in low efficiency, e.g. storing up of too much, the rise of lead times, out of time supplying, increasing costs, and a decrease in service quality (Mariani, 2007). On the other hand, with the expansion of densely populated cities, frequent deliveries of goods bring much traffic congestion and air pollution to urban areas. It increasingly stands opposite to the traffic condition and living space in cities. Since agri-products are daily consumed and in great demand, their logistics activities become particularly associated with some urban problems. In addition, inappropriate logistics facilities and information system probably lead to inadequate food safety, unbalanced supply and demand on agri-products markets. Food safety should be a top priority for clients and cold chain is especially required. Furthermore, information integrity and coherence enable high performance of food traceability system. Meanwhile, effective information communication connect producers and end markets.

7.1.2 Status quo of APL

(1) Increasing outputs of agri-products

Today's China has one fifth of the total population of the world, and hence in a broad sense, feeding its population lays the foundation for the whole country and all other industries. In the past, it was a challenge to produce enough food to cater a large population. In recent years, China has turned into a major global food exporter due to the advancements in the agriculture industry. Outputs of agri-products have been constantly increasing during these years. Table 7-1 lists the output of some major agri-products including grains, oil-bearing crops, meat and aquatic products from 2007 to 2011.

Table 7-1 Main agri-products output in China (2007-2011) (million tons)

Year Items	2007	2008	2009	2010	2011
Grains	50,160.30	52,870.92	53,082.08	54,647.70	57,121.00
Vegetables	56,452.00	59,240.40	61,823.80	65,099.40	67,900.00
Fruits	18136.30	19220.20	20395.50	21401.40	25236.80
Oil-bearing crops	2,568.70	2,952.82	3,154.29	3,230.10	3,279.00
Meat	6,865.72	7,278.74	7,649.75	7,925.80	7,957.00
Aquatic products	4,737	4,895	5,120	5,480	5,611

(2) Postharvest losses during logistics

China is intermediate in having both large-scale farming and significant smallholder production. It has been pointed out that the low efficiency of APL hinders the development of its agriculture industry.

Accenture survey reveals that “every year, inadequate cold logistics in China results in massive products losses largely because only 15% of all perishable products are transported by refrigerated vehicles, compared to nearly 90% in developed countries” (Accenture, 2006). Statistics offered by the China Ministry of Agriculture show that postharvest losses of grains and potatoes are estimated 7-11% and 15-20% respectively; fruits and vegetables lose 25% during picking, transportation, and storage. This means that 25 million tons of grains and 100 million tons of fruits and vegetables rot on average per year, while the postharvest loss rate is lower than 5% in some countries. Therefore, there is a need to pay special attention to the logistics process of agri-products after harvest.

Preliminary processing is crucial to prevent loss of agri-products during distribution. It covers cleaning-up, sorting, drying, pre-cooling, storage, refrigeration, and packaging. However, more than half of the preliminary processing tasks are undertaken by farmers or their cooperative organizations, even up to 80% in some cases. This becomes a major cause of postharvest losses due to a lack of adapted logistics facilities and technology using such as cold chain, refrigeration storage, professional packaging, and post-processing (see Table 7-2).

Table 7-2 Comparison of APL efficiency

Items \ Countries	USA	Japan, South Korea	China
Main distribution channels	Distribution centres	Wholesale markets	Wholesale markets
End consumer markets	Supermarkets, food stores	Supermarkets, food stores	Farm markets
Main distribution methods	Cold chains	Low-temperature	Normal temperature
Rate of cold chains	> 95%	> 95%	5%
Rate of preservation	> 50%	> 50%	10% - 20%
Loss rate	1% - 2%	< 5%	20% - 30%
Logistics cost	≈ 10%	≈ 10%	30% - 40%
Rate of margin	≈ 20%	≈ 10%	0% - 10%

Source: NDRC & Nankai-Logistics (2011).

Among which, a lag in cold chains especially aggravates the loss resulting from biological spoilage. Cold chain is a temperature-controlled supply chain which is essential for food preservation. Livestock products, fish, fruit and vegetables will lose value fast if

the refrigeration is not suitable (Hodges, et al., 2011). Take the refrigeration of fresh agri-products for example, the current cold storage capacity is 880 tons and per capita is only 7 kg; refrigerated trucks maintain about 40,000, accounting for freight cars, compared to just 0.3%, while this rate is 1% in USA, 2.6% in UK, and 3% in Germany.

(3) Contradiction between retail prices and farmers' income

The contradiction between high retail prices for consumers but low income for farmers has drawn considerable attention. A host of middlemen exist between producers and end consumers, which becomes a major factor leading to the contradiction.

It was revealed that even when vegetable prices were at their highest levels, farmers still did not make much money because of too many middlemen in the supply chain (Chiang & Edward, 2012). Nearly half of Chinese people are rural and the majority of them rely on the agriculture and related activities for their livelihoods. The price issue seems crucial for farmers' well-being. In some cases, farmers are weighing whether to give up farming and quit the fields for factories. As a result, eliminating this contradiction to improve the market efficiency is imperative.

On the other hand, high and unstable prices of agri-products are affecting the quality of urban life due to the rising costs of living. Figure 7-1 outlines the “footprint” of increasing prices of vegetables along the supply chain since multiple middlemen exist. Currently, the majority of agri-products have to experience a long journey: farmers – agency 1 – agency 2 – (or more agencies) – shippers – wholesaler 1 – wholesaler 2 – (or more wholesalers) – consumers. Take cabbage and shallot as examples, they are moved from the place of origin - Shouguang (located in Shandong Province) to the end consumers in Beijing covering about 515 KM, and the prices respectively increase tenfold and twentyfold when arriving in the end consumers.

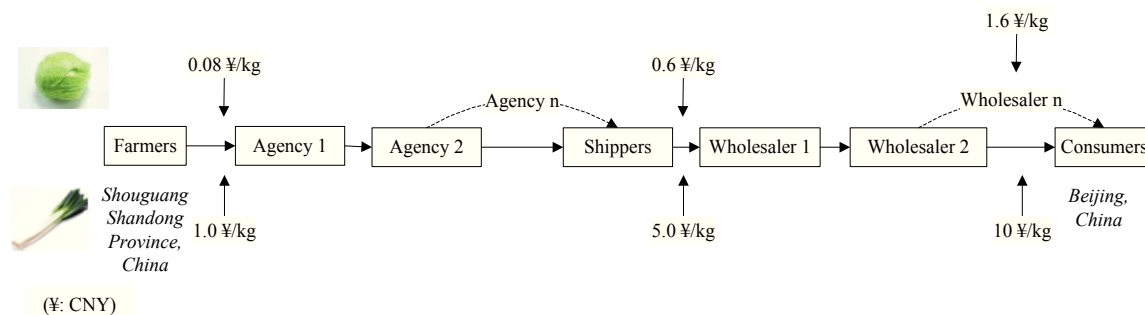


Figure 7-1 Prices increase along the supply chain with multiple middlemen

In addition to the reason of too many middlemen, traffic congestion adds the transport cost potentially. Typically about 80% of the local freight is operated by truck. A variety of extra costs relating to freight are embedded in the selling price, e.g. fuel consumption in traffic jams, fines on unqualified trucks, restriction for driving trucks in city centres, the difficulty of parking, losses during the trip. In order to avoid traffic congestion in metropolitan areas, large cities such as Beijing, Shanghai, Guangzhou, and Chengdu in China have executed driving restrictions for trucks to varying degrees. These restrictions relate to driving time, routes, vehicle types, and the pass issue.

In general, city logistics is regarded as the “last mile” of supply chains. “Last mile” freight has become a hot topic in cutting down selling prices of agri-products. However, the last leg of the freight system is challenging both cities and shippers. The city usually concerns capacity optimization and streets safety for all users, while shippers wish to minimize logistics costs without adversely affecting customer services and inventory policies (SDT, 2008).

In conclusion, some major features of APL in China are identified: significant postharvest loss of agri-products due to improper handling, storage, and transport especially the shortage of cold chains; too many middlemen in the supply chain resulting in consumers’ dissatisfaction with the retail prices also unequal actual profits for framers; social concerns about food safety have increased dramatically, which especially depends on the traceability.

7.1.3 Current status of city logistics

City logistics is regarded as values for a sustainable future considering the traffic circumstance, safety, and energy efficiency. It optimizes flows of goods and freight into and within metropolitan areas. City logistics presents three targets: mobility, sustainability, and liveability. Mobility ensures smooth and reliable traffic flows; sustainability makes cities more eco-friendly; liveability concerns the number of elderly residents in cities (Taniguchi, 2012).

(1) Depressing air quality

China’s ecological environment especially the air in cities has been a worrying problem. In mid-January 2013, Beijing and many other cities in China faced one of the worst periods of air quality in recent history. Extensive haze, low clouds, and fog stayed in these air-polluted areas for some days. The extremely terrible air pollution directly influenced the health of residents in these cities. A large body of local citizens suffered

illness caused by the air pollution and 20-30% of sufferers were related to respiratory problems at that period.

One of the leading causes of air pollution is the automobile emission. Especially in days with heavy fog, environmental capacity is limited in the face of too much automobile emission, thus the heavy fog mixed with pollutants is generated. Consequently, city logistics is highly relevant to the air quality in cities in line with the important component of its target - sustainability.

(2) Traffic congestion

Serious traffic congestion is a common phenomenon in big cities across China. As a result, the contradiction between urban freight and the quality of urban life is sharpening. Moreover, insufficient parking lots in inner cities aggravate urban freight distribution problems. In response to this, a series of vehicular and truck restrictions are carried out concerning lane, route, time-of-day, etc. Nevertheless, traffic congestion cannot be mitigated merely by such restriction policies. Consequently, it is necessary to implement the strategy for effectively managing freight from both the city and shipper perspectives. Examples of suggested strategies are (SDT, 2008): “(i) select distribution facility locations that maximize access to pick up and delivery destinations, (ii) utilize larger vehicles, (iii) consolidate shipments from multiple origins and along shared routes, (iv) co-load with multiple shippers or receivers, and (v) schedule deliveries outside of peak congestion periods”.

(3) Insufficient leveraging of public logistics infrastructures

Large scale retailers tend to own and use their own distribution systems, while smaller retailers may outsource the distribution function to 3PLs. However, the average scale of retailers in China remains small- to middle and the market concentration is still low. As a result, the advantageous scale effect and consolidated delivery are unable to be realized, for there is a short of integrated networks to support them. On the other hand, the value-added effect of supply chains driven by 3PLs is often overlooked. Actually, 3PLs network is regarded as an ideal solution to support retailers' logistics operations for the advantages of scale. As discussed earlier, FVs enable 3PLs to acquire more efficiency and consolidate freight flows into/within urban areas. FVs increase in number over the last two decades in China. However, city logistics has not made best use of the functions of such kind of public logistics infrastructures. Frequent shipments and unconsolidated deliveries greatly affect the mobility and sustainability.

(4) Inadequate information-based logistics operations

Automated information system improves the logistics efficiency, which relates to the intelligent and information-based logistics operations. The fact is that the main logistics activities are still operated by hand labour for the majority of freight distribution. In addition, information management systems have not been widely recognized and applied in the logistics field due to a lack of concern in using automated information system and related investments. This probably leads to inefficient transportation of goods and additional services regarding city logistics.

7.1.4 Existing APL modes

In general, there are several optional ways of physical distribution that are used by current APL in China. These channels are categorized into direct supplying mode, wholesaler-dominated mode, third-party mode, exporting-oriented mode (NDRC & Nankai-Logistics, 2011).

(1) Direct supplying mode (see Figure 7-2)

Direct supplying often takes place in local markets which is characterised by few middlemen between farmers and end consumers. Farm households are normally responsible for both production and basic logistics operations. Individual farmers produce and supply agri-products to the market independently which results in small-scale trading. Clearly, logistics services offered by this mode are usually unreliable due to their limited abilities. Moreover, individual farmers face difficulties in further processing which hinders adding more value to harvested agri-products. To some extent, the direct supplying mode is unreliable. It may easily get into risk caused by the changing consumer preference, bad weather of trading days, and backbreaking work on individual farmers, etc. Consequently, this mode seems impossible to stand up in a sustainable way and to accommodate to a more extensive trading area.

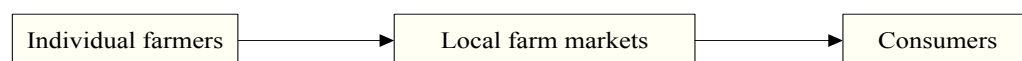


Figure 7-2 Direct supplying mode

Source: NDRC & Nankai-Logistics (2011).

(2) Wholesaler-dominated mode (see Figure 7-3)

Today wholesaler-dominated mode is a leading APL approach in China. Individual farmers and production bases are the major producers. Production bases provide

high-yielding outputs ensuring sufficient and steady supplies all over the country. They enable the utilization of advanced agriculture technologies as well as specialized and large-scale production.

Wholesaler-dominated APL mode is characterized by a large body of middlemen bringing a decrease in farmers' income and an increase in consumer spending. With regard to the quality and efficiency of logistics services, various uncertainties are probably resulted from the lack of professional logistics providers. Fierce competitions among middlemen force them to cut down the investment in logistics equipments so as to benefit more. Hence, this mode is not able to sustain better efficiency and balanced benefits.

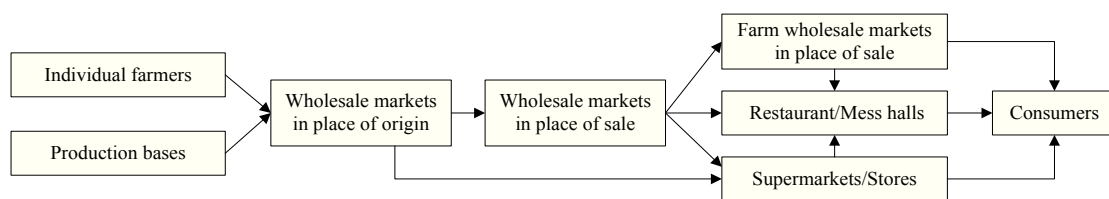


Figure 7-3 Wholesaler logistics mode

Source: NDRC & Nankai-Logistics (2011).

(3) Third-party mode (see Figure 7-4)

The third-party mode is much more efficient than the above two modes from a logistics perspective. By outsourcing logistics tasks to 3PLs, supply chains can benefit from professional logistics services. As a result, the labour division becomes clearer for every group of participants along the supply chain. They produce, package, storage, and transport with special focuses within their own areas. Thus, farmers can engage in producing without considering more about distribution and processing, and retailers can care more about their customer services.

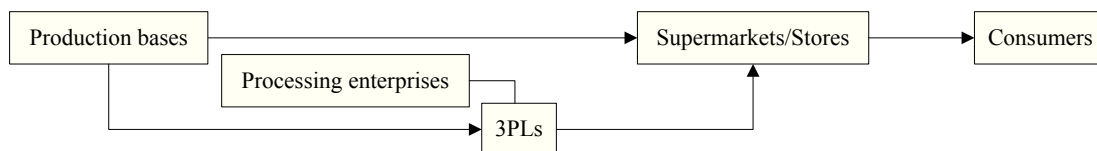


Figure 7-4 Third-party mode

Source: NDRC & Nankai-Logistics (2011).

Owing to the removal of numerous middlemen, it is able to enhance the quality and efficiency of the logistics. 3PLs connect the production side and the consumer side leading to the coordination between production and distribution. Furthermore, the interaction between processing enterprises and 3PLs improves the overall performance of

the supply chain and particularly gains more added values of agri-products. Third-party mode of APL is based on the contracts among producers, 3PLs, processing enterprises, and retailers. 3PLs offer services according to the agreement, which brings about controls for the entire logistics process to some extent. The production side and consumer side share their information via 3PLs, so as to balance supply and demand. Regarding the problems of APL in China, the third-party mode is a promising way. However, it is still in its infancy and not used so often in practice at present. In fact, a leading cause is that 3PL in China is in its starting stage encountering various challenges, in particular the lag in logistics equipments and technologies. Therefore, an upgraded solution based on this mode should be explored.

(4) Export-oriented mode (see Figure 7-5)

This export-oriented mode is devoted to the export of agri-products. As a part of agricultural export, processed foods exports grew markedly in a wide range of countries. The total processed food market was valued at US\$140.4 billion in 2011 in China, and processed foods grew at a CAGR (compound average growth rate) of 13.3% between 2007 and 2011 (NZTE, 2012). However, only about 30% of them are processed comparing to 60-80% in some developed countries. Manufacturing and exporting of processed foods contribute to add value to agri-products. It brings about a variety of benefits, e.g. income growth for farmers, increase of food availability, overcoming seasonality and perishability constraints, and potentials for the farm employment. It is pointed out that the improvements in food technologies, refrigeration facilities, transportation and supply chain management enable the processed food items readily tradable across national boundaries (Winger & Wall, 2006). Accordingly, the export of processed agri-products still has plenty of room for improvement. The efficiency and quality rely on related regulations and technologies.

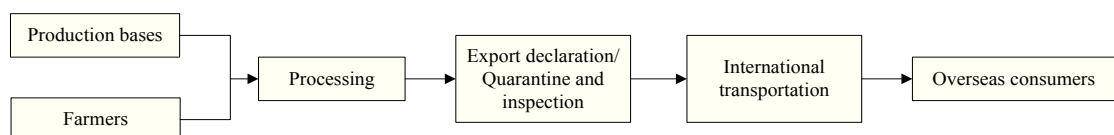


Figure 7-5 Export-oriented mode

Source: NDRC & Nankai-Logistics (2011).

Table 7-3 provides a summary of key features of the above APL modes. It covers the comparisons in terms of main logistics operators, logistics quality and efficiency.

Table 7-3 Comparisons of APL modes

Modes	Main operators	Logistics quality	Logistics efficiency
I	Farm households	Large losses; Low levels of cold storage, package, refrigerated transport, and added value	Direct and short distribution channel, few middlemen
II	Brokers, wholesalers, retailers	Losses, lack of service ability of logistics operators	A host of middlemen, time consuming, costly and complicated supply chains
III	3PLs	Supported by information systems and logistics network; Professionalization in logistics; Quality, safety, and availability of foods are ensured to some extent	Integration of logistics activities, reduction in the end cost and the number of middlemen throughout the chain
IV	Processing enterprises, foreign trade enterprises, 3PLs	Increase value-added functions through export-oriented processing	Follow the normal distribution processes; Largely depends on the policy environment and economic situations of importing countries

7.1.5 Future orientations

In viewing of the existing APL modes in China, the managerial ability to coordinate the business relationships among participants is in need. Future orientations are identified. Firstly, providing professional logistics services is required, in more detail, they are reliable and flexible transportation service, freight cost control, adapted processing and storage services. Secondly, it is noteworthy that the distribution chain should be as short as possible. It is necessary to find an efficient way to provide geographic coverage of agri-products shipment instead of relying largely on middlemen. The cluster of logistics facilities and services enables to overcome operational shortages by offering warehouse and storage areas, value-added services, intermodal extension of seaports, and the connection between producers and consumers. Thirdly, the coordination of overall participants is required to promote the information flow transparency throughout the whole supply chain. Effective coordination establishes stable relationships between producers, 3PLs, and consumers. The provision of market and price information can assist producers in their producing plans so as to reduce risks. As a result, the information-related gap can be closed and farmers profit more with a good understanding of the market demand. In addition, consumers are more likely to purchase foods that can be traced with open information throughout the supply chain.

7.2 Experiences learned

7.2.1 Japan: integration of logistics into public wholesale markets

Standing between producers and consumers, public wholesale markets in Japan play a leading role in smooth distribution of agri-products especially the fresh products. According to the Wholesale Market Regulatory Law issued in 1971, there are three categories of public wholesale markets in Japan: central wholesale markets, local wholesale markets, and others (under-scale wholesale markets) (Mittendorf & J.D.Tracey-White, 1992).

With the approval of the Ministry of Agriculture, central wholesale markets are usually established in inner cities with frequent deliveries and large amounts of consumption (Mittendorf & J.D.Tracey-White, 1992). Government is directly responsible for operating central wholesale markets. The Prefect-Governor approves the establishment of local wholesale markets considering specific surface areas. They are managed by farmers associations, trading companies, and other types of corporations. Local authorities administer the under-scale wholesale markets based on the dispositions in force in each region (Mittendorf & J.D.Tracey-White, 1992).

The efficiency of agri-products distribution in Japan is ensured by integrating logistics activities into wholesale markets. Various types of freight centers such as truck terminals and business districts exist in large cities of Japan. Among which, wholesale markets group small and medium wholesalers with logistics facilities and marketing services to cater to different verticals. Wholesalers offer related services for the distribution of agri-products such as transport, de-bulking, stocking, handling, and sometimes processing (Cadilhon, et al., 2002). The wholesale market-dominated distribution system has been in operation traditionally in Japan with the typical channel showed in Figure 7-6.

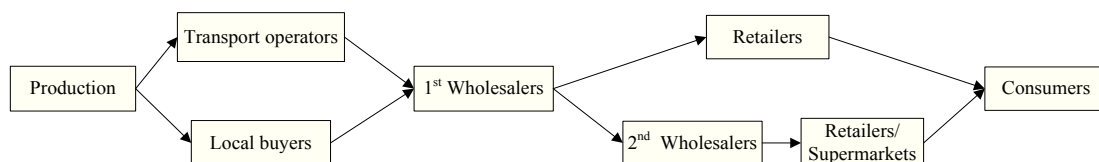


Figure 7-6 Traditional distribution system for agri-products in Japan

In detail, wholesale markets strengthen the efficiency of APL in Japan following this process (Wisetjindawat, 2010):

(1) Collection

In the wholesale market, 2-3 large scale wholesalers called 1st level wholesalers acquire a variety of agri-products in large quantities from all over the country as well as abroad. The products arrive at the market early every morning and then these 1st wholesalers bid to sell their goods to the second level wholesalers. Large-scale collection of agri-products enables a reduction in logistics cost especially the freight charges.

(2) Delivery

Wholesalers themselves or transport operators deliver goods to points of sale like supermarkets, shops, and other fresh markets. Logistics facilities owned by local governments are offered to these transport operators. The collected agri-products are dispatched in smaller quantities and directly delivered to retailers and 2nd wholesalers.

(3) Information of trading

Wholesale markets provide information concerning items and prices of available agri-products so as to avoid unfair and disordered trading. As a result, wholesale prices on the day are possible to be estimated. Prices are finally set by bidding, which fully reflects the current supply and demand. Besides, the payment during trading in the wholesale market is processed under agreements.

Regarding the information sharing among multiple wholesale markets, the Association of Central Wholesale Markets of Japan plays a role of information integrator. Apart from its head office in Tokyo's metropolitan central wholesale market, there are branch offices in other six regional wholesale markets. It performs multiple functions including regulating markets, monitoring the management of wholesale markets as well as their wholesalers, optimising distribution routes, and transferring related information.

(4) Food safety control

Wholesale markets are equipped with sanitation inspection stations to control the safety of agri-products. They provide monitoring, testing and inspecting for food products. Sanitation inspection stations also establish guidelines standards to traders within the market. In addition, a series of logistics-related facilities are provided such as cold storage, refrigerated trucks, and processing facilities.

The agricultural sector in Japan is characterized by smallholders and limited natural resources. Nevertheless, its APL performs nicely due to not only the promotion of logistics activities within wholesale markets, but also the enabler of public logistics infrastructure and agricultural cooperatives.

- Strengthen public logistics infrastructure

Japanese government attaches much importance on the construction of public logistics infrastructure (e.g. roads, ports, rail-road terminals, airports, highway network, logistics clusters) especially in medium and large cities so as to meet social demands. Strengthening public infrastructure contributes to the logistics efficiency especially the APL activities.

- Significant effects of agricultural cooperatives

Agricultural cooperative also called farmers' co-op, where farming resources (e.g. land, machinery) are pooled and members farm jointly (Cobia, 1989). The direct engagement of farmers' co-ops in wholesale markets is common in most cities of Japan. Farmers' co-ops provide their members with a range of services to so as to raise productivity levels and reduce the risk of small-scale farm householders. They promote extensive production, procurement, pricing and distribution; protect the interests of their members by financial support, bring in fertilisers and technologies, as well as procure agri-products supplies for the country-level food stock.

7.2.2 Kassel and Bremen: urban freight consolidation

7.2.2.1 Kassel freight model

The delivery of agri-products takes place frequently with a great quantity. APL is highly relevant to city logistics and put pressure on goods supplies. A considerable part of urban traffic is caused by ingoing and outgoing deliveries to/from retail shops, which results in traffic congestion and unnecessary journey. This also increases the cost of distribution and includes the added cost into retail prices. Thus, effective solutions to city logistics are needed to smooth the distribution of agri-products into and within inner cities. There have been significant developments in urban consolidation centre (UCC) schemes with the purpose of improving the coordination of goods movements.

The basic aim of city logistics is to coordinate and to bundle the deliveries of freight and goods (Köhler, 1999). City logistics plays an important role in balancing the city economic activities as well as social and environmental issues. It takes into account such aspects as energy consumption, pollution, congestion, safety, etc.

The city logistics scheme in the German City of Kassel was the implementation of an urban distribution center, through which the consolidated goods were delivered by a neutral freight forwarder to the inner city (see Figure 7-7). This project started in 1994,

which was initiated by the forwarding association and the chamber for industry and commerce in the city (Ramokgopa, 2004). It was carried out based on a series of survey studies relating to the requirements, volumes and acceptance of a city logistics approach. With an approximate population of 195,000 inhabitants and an area of 107 square kilometres, it is the third largest city in Hessen after Frankfurt am Main and Wiesbaden. There is a wide range of industries in Kassel focusing on automotive and transport industry, energy technology, telematics and software development, culture and tourism.

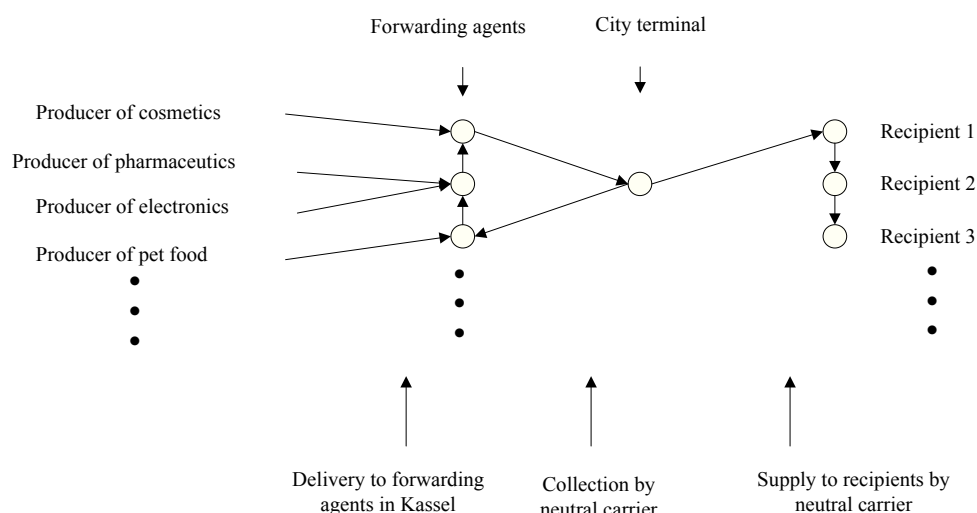


Figure 7-7 Former Kassel model for city logistics

Source: Köhler (1999).

In general, the project comprised processes of collection, consolidation and storing, and delivery. A neutral carrier (transport operator) was responsible for the collection and delivery of goods where were scheduled to be forwarded to the recipients in the inner city. He was employed by groups of forwarding agents.

(1) Collection

On behalf of the forwarding agents in Kassel, the neutral carrier used 5 vehicles to collect the goods from 10 forwarding agents' depots during the night.

(2) Consolidation and storing

Then the collected goods were consolidated and stored in an urban distribution center. At the urban distribution center, the collected consignments were bundled according to the address of the consignees as well as to specific street corridors (Ramokgopa, 2004).

(3) Delivery

At about 10.00 o' clock, the delivery started with two or three specially labelled city

logistics lorries (total authorised weight 7.5 ton). Normally two tours were carried out per day. The number of lorries and necessary routes depended on the actual delivery demand.

During the above processes, the neutral carrier and forwarding agents shared information through electronic methods. Forwarding agents informed the neutral carrier about their transport volume in advance by e-mail. The neutral carrier would contact the forwarding agent who had placed the order via telephone in case a delivery task was cancelled.

There was no extra charge for deliveries. Services offered according to the neutral carrier was paid by a specific city logistics tariff. Besides, the logistics facilities were provided by the local government and operated by private companies, which could be viewed as Public Private Partnership (PPP).

Through implementing this project, the mileage towards and within the inner city reduced 40% and 60% respectively. The average of lorry frequency per retail (number of lorries/number) reduced 13%. Vehicle saturation either in volume or in weight doubled and the delivery weight per stop increased 15% (Köhler, 2003).

Unfortunately this project was abandoned probably due to a series of problems, e.g. some forwarding agents left the cooperation, a lack of freight center in Kassel, insufficient interactions among the participants, no tangible benefits for participants, and few actual cost savings. However, the consolidated delivery was regarded as an effective solution to reduce delivery trips and emissions within inner cities.

On the basis of experience of the former scheme, a new Kassel city logistics model was proposed (see Figure 7-8). The involvement of a traffic center terminal (FCT) mostly differentiates the new Kassel model from the former practice. FCT offers a specific area for forwarding agents to arrange the consolidation and transportation of their goods, which probably avoid necessary trips during the collecting trips occurred in the former model. Another distinction is the consideration of home delivery service and waste disposal service for the city. Home delivery is often available for fast food and other convenience products. Sometimes home delivery of supermarket goods is possible (Wikipedia, 2012). Waste management relates to the collection, transport, processing or disposal, managing and monitoring of waste materials (Wikipedia, 2013c). In order to make related information flows available for all participants, a city-logistics company was established. Information system is applied to optimize shipping routes and schedules also track and trace goods. Compared with the former one, the new Kassel model was built upon the consolidation function through a FCT and information management.

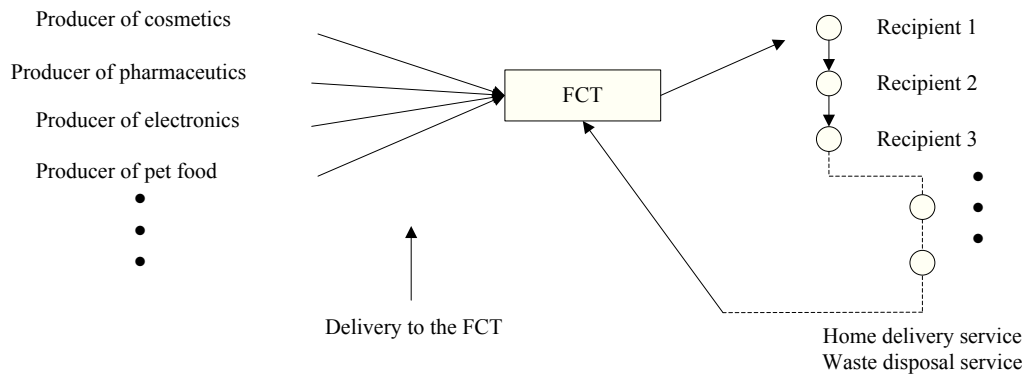


Figure 7-8 New Kassel model for city logistics

Source: Köhler (2003).

7.2.2.2 City logistics experience in Bremen

In another German city of Bremen, a city logistics project was carried out by GVZ Bremen since 1991 and ended in 2005. The key objective of this project was to realize sustainable urban mobility through reducing emissions and improving the overall efficiency of goods delivery in Bremen (CIVITAS & VIVALDI, 2006).

This project experienced three stages (Nobel, et al., 2012):

(1) Initial stage (1991-1993)

Due to the long waiting time for specific customers, several logistics enterprises in GVZ Bremen organized the project of “City Logistics Bremen”. They transported the goods destined for their clients by “combined” vehicles. At the first stage of this project, only the FV-Development Company (GVZe) was in charge of managing the combined shipments.

(2) Successful stage (1994-2000)

The GVZ City-Logistik Bremen GmbH established in June 1994, which played a large role in conducting this project. At that time, GVZe owned 26% of the capital stock of this company and various forwarding agents in the GVZ Bremen acted as the rest of the shareholders. About 1,500 ton of cargo were served up to 150 consignees per month. Goods were delivered daily at the GVZ Bremen and then sent to the shopping centres and central warehouses. The city logistics project reduced about 9,000 km of truck mileage per month on average. It also represented a considerable reduction in emissions by saving about 1,100 litres of diesel fuel per month (CIVITAS & VIVALDI, 2006).

Regarding the organization structure, the GVZ City-Logistik Bremen GmbH created the round table – “City Logistics Experts Circle”. A wide range of members were

involved including city municipality of Bremen, individual enterprises located in the GVZ Bremen, the chamber of commerce, and representatives of retail stores. They offered a joint effort aims at finding better solutions to city logistics.

(3) Disillusion and reorganization stage (2001-2005)

At this stage, because of the resignation of several forwarding agents, the GVZ City-Logistik Bremen GmbH had to be reorganized. All tours to the city center were thus discontinued, probably due to the decreasing willingness to cooperate, increasing intensity of competition, and high expenditure in city logistics services. This project was finally abandoned although VIVADI-activities had intended to restart city logistics program. This city logistics project in Bremen could not continue to move forward in the face of the shortage of public subsidies and the economic burden of using eco-friendly vehicles. However, it offers a typical example in support of the role of FVs in city logistics and the contribution of consolidated distribution to sustainable urban mobility.

7.2.3 APL practice in USA

Due to a complex and efficient APL system, USA has a leading position in agricultural production and trade. Agricultural production and distribution in USA are characterised by large scale, specialization, and regionalization. Individual farm householders are usually engaged in mass production, and therefore a large-scale APL system is required. In addition, the level of productive regionalization is high, which results in regional specialization in the production of corn, wheat, soybean, vegetables, and fruits, etc. Productive centralization features prominently and the amount of agri-products supplied by Newyork, Washington and Michigan accounts for 70%. Direct contacts between producers and consumers or processors are possible. The APL efficiency is thus ensured by reducing the transactions between numerous middlemen. As a result, APL in USA gives priority to the direct-sales pattern. Around 78.5% of the agri-products are directly distributed from producers to retailers with the support from logistics/freight/distribution centers directly, and only 20% are sold through wholesalers. Clearly, the majority of agri-products are distributed without the intervention of too many middlemen, which brings high logistics efficiency and reduction in the logistics cost.

In conclusion, the superiority of APL in USA is created from several aspects.

First, the infrastructure and facilities provide a good foundation for the APL. Transport infrastructure including road, rail, and waterway can reach to most households. Moreover, information communication facilities and network, mechanized operations,

and proper logistics equipments contribute a lot to the country-level APL development.

Second, the information base relating to the agricultural sector is well developed, and the internet penetration of peasants reaches up to 85%. This leads to a high rate of e-commerce for agri-products which ranks fifth comparing other industries. For example, Chicago Board of Trade (CBOT), established by 82 grain merchants in 1848, which is one of the most representative platforms for the trading of agri-products. Nowadays, the prices of corn, soybean, and wheat traded through CBOT can be the reference price for the agricultural industry in USA and also the authoritative price guide for the worldwide trading. COBT offers a lot of useful information for the stakeholders to know about the market situation and price fluctuations.

Third, the socialization of logistics services brings the involvement of multiple agricultural participants such as farmers' co-op, credit agencies, markets, wholesalers, storage and transport agents. For example, nearly 1/3 market share of the grain trading in USA is operated by farmers' co-ops.

Fourth, the government regulates APL excluding direct intervention in farmers' production and operation activities. In detail, the government legislates to formulate standards for the logistics market, thereby a well external circumstance is created for the APL development. Logistics infrastructure construction and numerous distribution centers are constructed, which enables the cooperation between retailers and producers. Additionally, the government offers authoritative information services. About 100,000 professionals affiliating to the United States Department of Agriculture engage in agricultural information statistics in terms of variety, area, growth, and output of farms in various regions. The collected information is released after processing, thereby guiding the production and operation activities for agri-products.

Additionally, levels of the educational attainment of APL participants in USA are generally high. 92% of them have a bachelor degree or higher, and 41% hold a master degree; 22% have a professional certificate in the specialized field of distribution and storage. Well-educated professionals have contributed to the efficient operations of APL in USA. As a result, APL performs nicely in support of other industries.

7.2.4 APL practice in Netherland

Netherland is a major logistics provider of agri-products for other countries. FVs or logistics clusters for agri-products provide adequate refrigeration technologies and equipments, which offer efficient services for transport, storage, and distribution.

Agricultural logistics centers in different places have evolved into differing functions. For example, Rotterdam Port plays an important role in coordinating combined transport of grains, fish, meat, and fruits. It is one of the biggest importers/exporters of cocoa in the world also the main port for handling cocoa beans in bulk in Europe. To meet the increasing demand for the cocoa beans storage, Amsterdam Port has established ultramodern cocoa warehouses. Flushing Port focuses on fruits services and manifests itself as a banana harbour increasingly. The main activities are conditioned cooling and distribution together with the complete logistics care and all re-packing activities (Jansen, 2011). Besides, the wide use of electronic ordering system combines suppliers, producers, wholesalers, and retailers, thus virtual integrated supply chains are formed to serve worldwide customers. Due to the convenient sharing of the on-line information, the supply chain becomes more flexible. Therefore, logistics processes such as planning, managing, allocation, and optimization can be realized easily. This virtual platform enables especially flowers export to more countries.

7.2.5 Implications of experiences

Traditionally, the middleman plays a big role in developing farms especially in the distribution of agri-products. They purchase agri-products from farmers, and then either sells them at the retail price or sells them at the wholesale price to other distributors (wiseGEEK, 2012). It has been said that middlemen are the biggest group of winners in China's APL. However, if middlemen are eliminated, farmers will have to take over the operations also risks in distributing. In addition, middlemen can provide quick money that is urgently needed at their farms. Farmers usually face hard situations after the harvest such as inadequate transportation, storage, and further processing, and middlemen have ways out of such situations. Accordingly, it seems that they are inevitable in the supply chain of agri-products.

The Japan experience brings concepts similar to FVs in APL rather than middlemen. As a top administrator for the Japanese APL, Japan Ministry of Agriculture built a suitable regulatory system for the market. As a result, mismanagement and multiple regulators are probably avoided, leading to more efficiencies of APL's operations and managing for both producer and consumer interests. Under the guidance of the regulatory system, wholesale markets are equipped with facilities for APL such as storage, air cooling and refrigeration, distribution and processing facilities, and information technology. Actually such wholesale markets are increasingly evolved into agricultural FVs (agri-FVs)

today. Logistics flow and commodity flow are combined by means of wholesale markets so as to integrate the supply chain of agri-products.

Cases of Kassel and Bremen point out that a solution to sustainable urban freight is using freight terminals (e.g. FVs) located on the outskirts of the city with consolidated logistics operations. Although various categories of goods are covered in these cases, the involvement of FV concept in the freight consolidation is worth considering as well in APL. FVs are able to back up city logistics to optimize and reduce cargo traffic through a consolidated distribution. Sustainable outcomes mostly benefit densely populated urban areas, e.g. less fuel and oil consumption, less congestion, air pollution and noise.

The following three considerations based on the experiences offer implications for the APL development in China:

First, to a significant degree, efficient APL is resulted from efforts in reinforcing logistics infrastructure and facilities. In particular, the availability of public transport infrastructure and refrigerating equipments are necessary to meet the needs of APL.

Second, special nodes with logistics functions linking farm householders and buyers can provide intensive logistics services in response to diverse demands. For example, FVs either in general type or APL-based type are typical in practice. Besides, a wholesale market with additional functions such as refrigeration storage and transport basically lever APL development. In other words, wholesale markets have performed as FVs to some extent.

Third, shifting from an emphasis on functions to the process, integrated logistics performance is gaining attention. Facing this, the trend of supply chain integration of agri-products expands operational potentials and impacts of logistics. As a result, the organizing approach trends to be more intensive. For example, intensive production and economies of scale at the production phase can be promoted by farmers' co-ops, production bases or agribusiness corporations. Regarding the marketing channel to end consumers, the retail chain enables the connection between production and markets by its positive pull effects on APL. Supermarkets are characterized by bulk buying as well as balancing supply and perennial sales, which cater to the concentration of production and the utilization of FVs. This brings about more efficiencies and better quality of logistics by eliminating middlemen as far as possible. Currently, 60-80% agri-products are sold by supermarkets in some developed countries, while this share in China is about 20% now.

It is clear that adequate information service assists to add values throughout the whole supply chain of agri-products. Information service focuses on providing market

information to farmers, sharing production and trade situations to buyers.

7.3 FVs leveraging integrated APL toward sustainability

7.3.1 Integration of logistics

Integration is frequently cited as being a critical issue in multiple organizations context. Through organised working or harmonious action of individual work, it manages dependencies and joint efforts of members for optimised performance (Malone & Crowston, 1994).

The logistics concept can be described as the streamlining of materials, information, and finances moving from the supply side to the consumer side. It coordinates and integrates such flows among the sections partners within a supply chain, e.g. manufacturers, shippers, wholesalers, retailers. Logistics inherently integrates customer requirements, internal processes, and upstream suppliers (Tan, et al., 1999). Hence, the integration of logistics in a broad sense refers to the coordination of activities along distribution channels, such as production and purchase planning, as well as inventory management and transportation. Integration aims to create “seamless” supply chains with fully integrated upward information and downward material flows (Danese, et al., 2013).

Logistics integration has been analysed from different perspectives: (i) the integration with suppliers and customers, (ii) upstream integration, i.e. the integration with suppliers, and (iii) the integration with buyers.

7.3.2 Transformations

Considering the probable future trends in APL development, this research will look at three transformations toward integrated APL in China. Transformation A (farmers’ co-ops) and transformation B (chain stores) originate from the perspectives of producers and consumers respectively. In this context, both of the production and consumption require a solution to meet the large-scale and consolidated agri-products distribution with quality guarantee. Transformation C (agri-FVs) becomes a key link between them combining the business flow and logistics flow. As the core of the integrated APL system, the FV solution enables the economics of scale of agri-products as well as high efficiency of chain retailing.

(1) Transformation A: independent producers (e.g. small-scale farm householders, family farmers) are organized into farmers’ co-ops

There are several features of agricultural production in China: (i) farmer householders produce in small scale individually, (ii) production largely relies on natural conditions, resulting in unstable output and varying quality levels of agri-products, and (iii) seasonality and regionalism. These features impact farmers' profits, and in particular unpredictable weather threatens their outputs. Small scale and individual farm householders are powerless in facing the natural disasters. Meanwhile, it is nothing new that farmers suffer heavy crop losses, usually due to the lack of information, insufficient processing, distribution, and marketing for their products.

Farmers' co-op plays an important role in assisting farmers to reduce risks and acquire more useful information. As a form of business organization, farmers' co-ops pool their members' production and/or resources in certain areas. This adapts well to the current situations of the agriculture industry, as it is difficult for farmers to produce and undertake a range of logistics operations as well as search for markets by themselves. Farmers' co-op promotes them to join together as an "association". As a result, their members can gain a better outcome and typical financial support, than by going alone. The "co-op approach" is aligned with the trend of economies of scale and can also be regarded as a form of economic synergy.

Farmers' co-ops provide the institutional framework to build sustainable economic and social communities for farmers. Foremost, by means of building up a product-selling bridge between the farmer and the market, they "liberate" farmers out of the difficulty of profitably selling products. Second, they can improve farmers' bargaining power in dealing with buyers regarding intermediaries and wholesalers. In addition, they transform their intensive farming systems into resource efficiency and quality controlling of products. These co-ops assist farmers to scale up the operation constantly and adopt standardization for production, as well as improve products quality and promote processing and exports. Importantly, they have the ability to find financial supports and offer technological guidance for their members.

(2) Transformation B: sales channels develop into chain stores

Sales channel defined in this study refers to a way of bringing products or services to markets so that they can be purchased by consumers. As one of the oldest forms - direct selling by small-scale farmers, farmers market dominates the sales channel of agri-products in China traditionally. This traditional form is characterized by small scale and multi-step trading process. However, the quality control of agri-products traded

through farm markets becomes quite difficult, due to the untraceable sources of agri-products and inadequate storage facilities.

Chain retail is also called chain stores and supermarkets. They share a brand and central management, and usually have centralized purchasing, decentralized marketing as well as standardized business methods and practices. The well-known supermarkets like Wal-Mart Stores, Inc., Carrefour group are examples offering a wide variety of merchandise. Another form of stores offering specific and specialized types of items is usually named specialty store. These stores focus on selling a particular brand, or a particular type of items (wisegeek, 2013). For example, a store that exclusively sells meat, fruits or cheese, would be considered specialized. Some specialty stores are involved in a chain for chain retail. Chain stores have not only reformed the logistics sector, but also will promote the standardization and modernization of agri-products and their logistics. Supermarkets were almost unknown before 1990 in China. There was already a migration of consumers from traditional wet market shopping into supermarkets for fresh foods (Hu, et al., 2004). Chain retailing of agri-products has several advantages: the connection between production and marketing responses to the marketing problem for the majority of farmer operators, which probably increase their incomes. On one hand, these stores and supermarkets can collect and arrange the information about the agri-products market and then transferred to farmers. This will help farmers to adjust their output to meet market needs, thereby optimizing the allocation of resources. On the other hand, it would be helpful for improving the position of farmers in price negotiation.

Chain retail of agri-products is useful with regard to rural industrialization. First, chain retailing needs the support of industrialization by means of the resource integration along the supply chain. Agricultural development trends toward industrialized production since large-scale supply is founded on the mass-production. Second, chain retailing brings market prospects for the industrialized agricultural production and contract farming. In order to meet the requirements of chain retailing and industrialized operations, agri-products bases, processors and other intermediaries are required to comply with standardized practice and making to order production. As a result, the win-win effect will probably become a reality across the supply chain.

Chain retailing of agri-products is indispensable to the integrated APL system. However, it could be found out several hardships for the chain retailing of agri-products in China. First, non-standardization of agri-products affects the brand trust and effect of chain stores. In particular, a lack of labelling provision during production, processing and

distribution makes the quality guarantee impractical. In addition, some chain retailers can not offer identical products with the same services and same prices. Hence, the advantage of brand share seems impossible. Second, better food processing can increase the value of agri-products, while most of them are processed roughly and intensive processing is still limited. To a large extent, the chain retailing of agri-products in China is shackled by such uncompetitive products resulting from the lag in processing. Third, the lack of efficient services offered by 3PLs and backward distribution system are limiting the development of agri-products chain retailing. As most of retailers can not finance the logistics or distribution by themselves, 3PLs and public logistics facilities become particularly necessary. Cold storage facilities and information system are usually regarded as the major factors driving the chain retailing of agri-products. The statistics points out that the logistics cost of agri-products accounts for 30% to 40% of total cost, even 30% for fresh items, while this ratio is less than 10% in some developed countries. Besides, in most cases the economies of scale can not be achieved, due to the limited business scale of chain retailing. Such chain stores rarely actively engage in the interactions with production bases and competent distributors. As a result, it is difficult to realize production-to-order, massive procurement, and professional distribution. Some times these stores and supermarkets even directly purchase from farm markets which cause frustrations in achieving economies of scale of distribution.

- (3) **Transformation C:** use agri-FVs to integrate independent organizations including wholesalers, intermediaries, transportation agents, storage agents, food processors and export traders, etc.

Agri-FV is a concept aligned with the extension of FV using to the field of APL. Generally it refers to a certain area offering various services related to logistics and value-added activities specially for agri-products. Agri-FVs strengthen the link between agriculture and trading and potentially address issues affecting food security.

Proper logistics nodes have gained much attention in terms of efficient economic growth especially from agricultural countries. On one hand, farmers and other agricultural producers often meet difficulties in selling their agri-products. On the other hand, the lack of efficient logistics system affects retailers operations. Agri-FVs provide services of processing, marketing, storage, and information about market transaction. Accordingly, they are increasingly implemented in practice worldwide.

As mentioned previously, many farmers have experienced difficulties in selling their

products, which are related with distribution channels, cold storage, packaging, bar codes and quality certificate, etc. As a link between producers and customers, basically an agri-FV is built to ensure a smooth distribution channel for agri-products moving from farmers to customers. After organizing the collection of products from their members, farmers' co-ops sell these products to agri-FVs where primary processing, sorting, storage take place.

Some problems relating to urban life arise with the urban population growth and heavy traffic. The wholesale market areas are overcrowded leading to activities spilling over onto adjacent streets. Moreover, parking space is often limited and waste management is often lacking. The existing wholesale marketing system is not able to accommodate to the increased demands and accordingly causes traffic congestion and delays. As a consequence, enough space for the efficient movement of agri-products within inner cities is imperative. Under this background, new wholesale markets built in western countries especially in developed countries slowed down over the past few decades. The already existing wholesale markets have tended to attract warehouses for integrated food distribution, changing their roles to "food centers" (in the USA) (Tracey-White, 1991).

Considering the development trends of wholesale markets and seaports, this research expands the function of an agri-FV in line with the integration of logistics evolution-associating with export and urban distribution channel. The basic functions of agri-FVs are similar to the general ones. Although they specialize in agri-products distribution, general logistics activities are indispensable, such as transportation, storage, handling, distribution processing, packaging, information processing.

7.3.3 Interacting mechanism

The term "synergistic effect" originates from Biochemistry, which refers to an increased intensity caused by the combination of two substances of an organism. It is used in other fields representing an effect arising between two or more substances, which is greater than the sum of their individual effects. The three transformations lead to the sustainability in agri-products supply chains with their synergistic effects. On the basis of their individual effects and roles, an integrated system is provided for the agricultural logistics by their interactions.

Figure 7-9 depicts an interacting mechanism driving synergistic effects by the combination of farmers' co-ops, agri-FVs, and chain retail. The synergistic effects are

created by the involvement of solutions, outcomes, requirements, and concerns.

- “Solution” means, for example $S: A \rightarrow B$, A can deal with B or A can support B to a great extent;
- “Outcome” refers to a result or consequence of related action or process;
- “Requirement” represents, for example, $R: A \rightarrow B$, B is a requirement of A;
- “Concerns” are expectations from perspectives of consumers, farmers, society (government sectors and industries), and ecological environment.

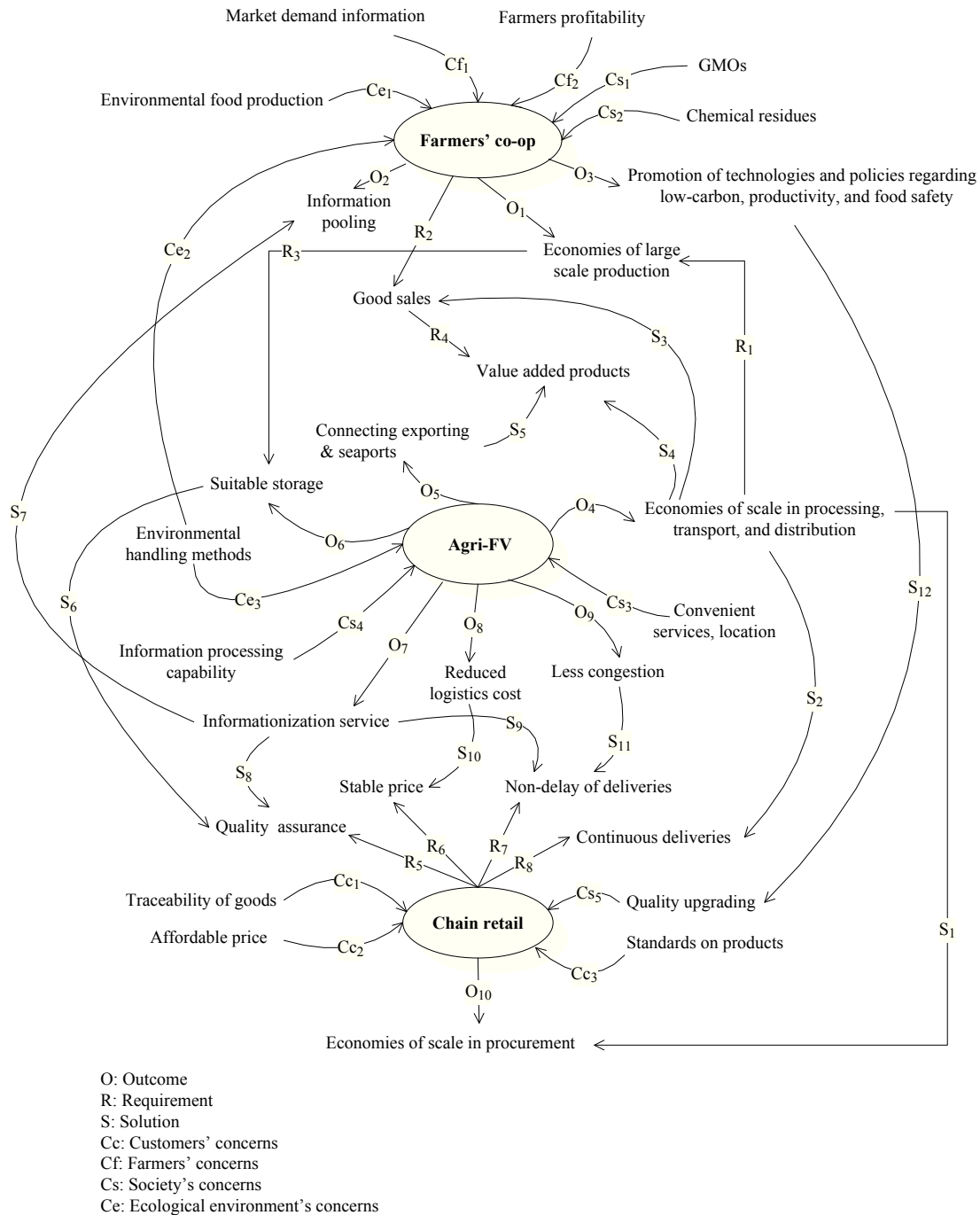


Figure 7-9 Interacting mechanism involving three transformations in APL

On the whole, the synergistic effects arise in the context of economies of scale. In detail, the approach of farmers' co-op results in economics large scale of production (shown as O_1). Meanwhile, the effect of agri-FV is exhibited in the economies of scale of processing, transport, and distribution (shown as O_4). This leads to demands for growing volumes of agri-products and stable delivery capacities of homogeneous quality (shown as R_1). From the consumption side, economics scale of purchase brings cost advantages for chaining retailers (shown as O_{10}), which relies on the economies of scale of processing, transport and distribution (shown as S_1). This clue mostly represents the ideal trend of APL development in China. It stands for the synergy generated by economies of scale in prduction, circulation, and marketing.

Several examples are given in order to explain the involved clues in this interacting mechanism. Food and agribusiness chains are tightly related to food quality (shown as Cs_5, Cc_3) and safety (shown as Cc_1), as well as environmental friendly food production (shown as Ce_1) and handling methods (shown as Ce_3). Thus, fundamentally innovatory solutions for developing, producing, and marketing are required. In addition, supermarket procurement regimes for sourcing of fruits, vegetables, dairy and meat strongly influence the organization of distribution channels (Ruben, et al., 2006).

The market concerns quality guarantee (shown as R_5), stable price (shown as R_6), non-delay in deliveries (shown as R_7), and continuous deliveries (shown as R_8). Solutions (shown as $S_2, S_8, S_9, S_{10}, S_{11}$) generated by the effects brought by agri-FVs can prospectively meet such requirements.

Social concerns such as genetically modified organisms (GMOs) (shown as Cs_1) and chemical residues (shown as Cs_2) during the production are challenging in increasing global competitions. Farmers' co-op is able to promote technologies and policies regarding low-carbon, productivity, and food security in organizing members' production, so as to respond to the concerns from consumers, farmers, society, and ecological environment (shown as S_{12}).

As a central link, outcomes of the agri-FV (e.g. O_5 : connecting exporting and seaports, O_6 : suitable storage, O_7 : informationization service, O_8 : reduced logistics cost, O_9 : less congestion) probably enable the value adding of agri-products (shown as S_5), guarantee of quality (shown as S_6, S_8), stable prices (shown as S_{10}), and non-delay of deliveries (shown as S_{11}).

Owing to the cluster of 3PL services and other functions, an agri-FV provides a platform for agri-products to compete in both domestic and international markets for the

following reasons (see Figure 7-10).

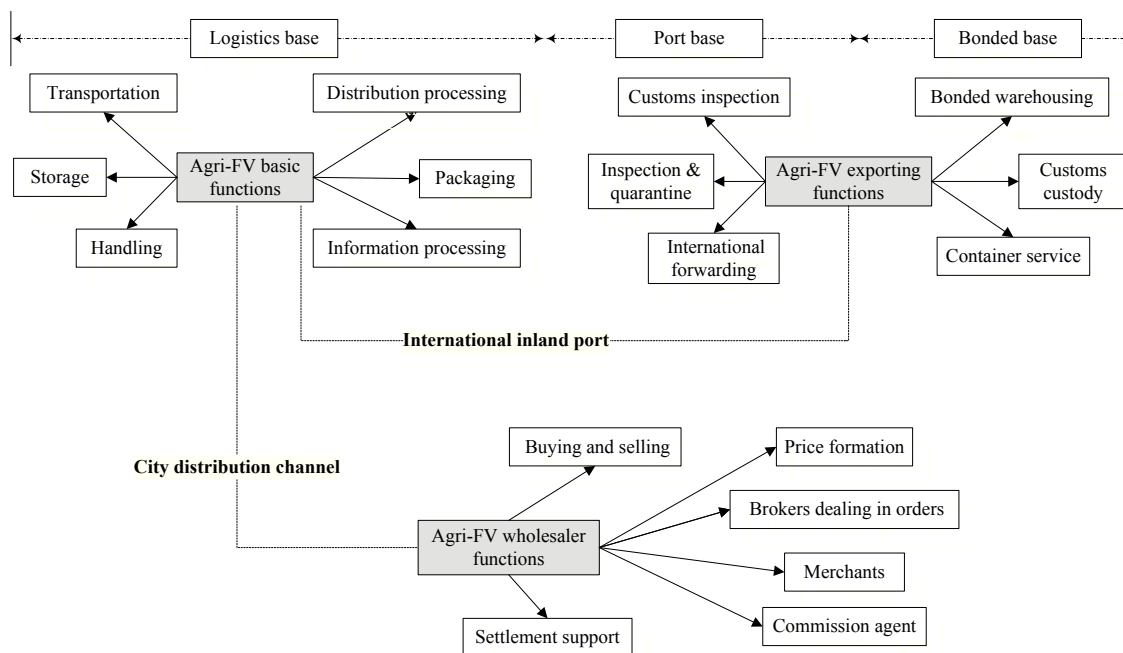


Figure 7-10 Basic and extended functions of an agri-FV

First of all, in this research, an agri-FV is regarded as an area having wholesaler activities rather than purely offering logistics-related services. This will be an important transformation for usual wholesale markets and agriculture-related logistics sites. The wholesale market plays a major role in agri-products distribution in Japan largely due to the additional logistics functions. Hence, for the transformation to an agri-FV, the basic functions of a wholesale market should be considered, e.g. buying and selling, price formation, brokers, merchants, commission agents, and settlement support.

Second, increasing cooperations between seaports and inland terminals have extended gates to hinterlands opening the potential market for both of them. Moreover, high-capability rail-shuttles greatly expand the seaport hinterland network. Meanwhile, such cooperations bring more opportunities for the export of agri-products. An agri-FV is able to offer a series of services relating to the export including customs inspection, inspection and quarantine, bonded warehousing, customs custody, container service, international forwarding, etc. (Dong, 2012). Attracted by these convenient services and special preferences, numerous enterprises engaged in export processing, commerce and trading cluster in such FVs. In one sense, such an agri-FV acts as an international inland port concerning its exporting functions.

Third, as a solution to the city logistics, agri-FVs can potentially improve goods deliveries in urban areas by the use of consolidation depots and distribution networks.

Agri-FV in this research inherits the function of a wholesale market (or central market) and most importantly involves the logistics support. As discussed, some terminal wholesale markets in less-developed countries are usually ones with congestion caused by an unsuitable location or by an inappropriate mixture of wholesale and retail functions (Tracey-White, 1991). In response to the population growth, changes in urban land-using patterns and the development of modern transport systems, agri-FVs built in urban fringe can probably lighten the traffic and environmental burdens on inner cities.

7.3.4 Agri-FV: a lever for sustainability

Adaptive logistics operations lead to better efficiency for the connection between the production side and the consumption side. Agri-FV can provide a lever for the sustainability of the agriculture sector. To this end, the sustainability is mainly presented from such aspects: economic stability of farmers or other agri-producers; ecological environment protection during production and distribution; food safety assurance; affordable retail prices for consumers. In more detail, topics relating to the sustainability leveraged by agri-FVs are listed as follows:

- Sustainability of agri-products supply chain
- Improved livelihoods of farmers, livestock keepers and fishers, e.g. better crops, forest products, and pest control
- New and more sustainable approaches to food (e.g. organic food) production
- Reasonable prices to consumers and economic returns to farmers
- Fewer intermediaries and less transport cost per unit
- Loss minimisation in logistics especially for the chilled and fresh agri-products
- Effective technological solutions to food processing, packaging, and transportation for the energy-efficiency
- Added value of agri-products through packaging, processing, etc
- Traceability and trackability for the quality guarantee and hygienically substandard commodities
- Less traffic congestion and pollutions to cities

7.4 Integrated APL approaches

Based on the three transformations and their interacting mechanism, this study, from the perspective of the whole agricultural supply chain, proposes an integrated framework to accommodate to these trends (transformation A, B, C) and the needs of APL in China. It

provides two main channels with the involvement of agri-FVs as shown in Figure 7-11.

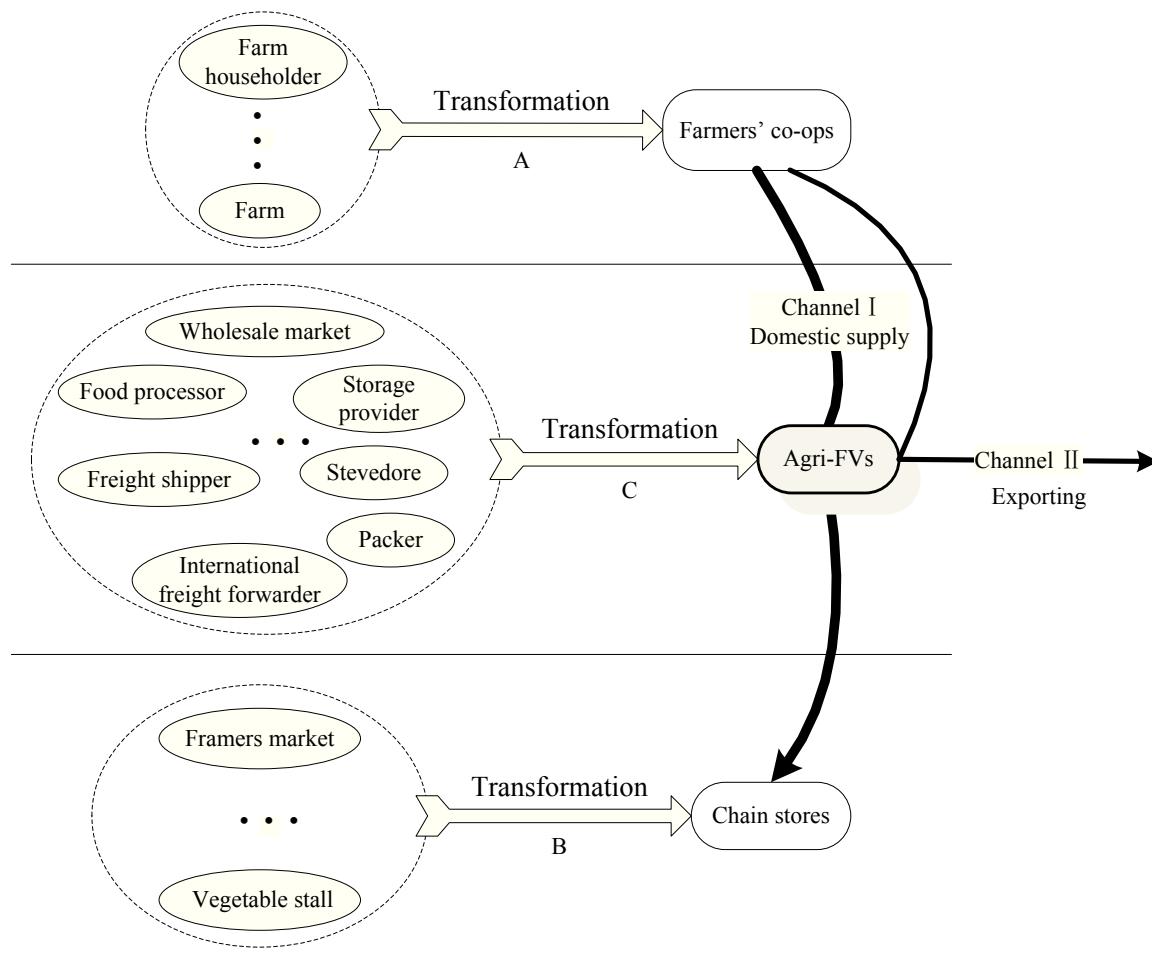


Figure 7-11 Integrated APL system with transformations

7.4.1 Channel I: farmers' co-ops + agri-FVs + chain stores

7.4.1.1 "Farming-supermarket docking" strategy

Introduction

Channel I focuses on the domestic supply of agri-products. This main channel supports the "farming-supermarket docking" (FS-docking) strategy execution which is encouraged by both of the academia and authority in China. FS-docking relates the direct supplies of agri-products from farmers to supermarkets based on their signed agreement of intent. In recent years, it has been a hot issue due to a series of challenges faced with, such as farmers' difficulties in selling, food safety control, and unreasonable retail prices for consumers, and consumer demand for food diversity. FS-docking approach has been traditionally a mature supply mode in some countries. In USA, around 78.5% of the total

agri-products arrive to consumers following the channel: production areas – distribution centers – supermarkets and chain stores – end consumers. In addition, 20% of them follow this channel: producers – wholesale markets – vendors, and only 1.5% of agri-products are sold at farmers markets. Such kinds of APL channels are characterized by few middlemen, reliable distribution, cost-effective, and high-efficiency. Although the traditional wholesale market dominates in Japan's agri-products supply, they also started to explore a more direct solution since 1990s so as to reduce cost. The practices of direct distribution of agri-products in Japan mainly relate two ways: one is that farmers seek help from co-ops, or they are organized together to sell their products directly to the customers. As a result, the retail prices are reduced by 20% to 30%. In addition, some chain stores/supermarkets acquire the products. Skipping the wholesale markets, thereby an average 10% cheaper price is offered for customers. USA has a good run in FS-docking, partly because the positions of producers and terminal business are equal.

In academic research, Thomas Reardon and Julio A. Berdegue (2002) state that the direct trading between supermarkets and large-scale food manufacturers has deeply transformed agri-food markets in Latin America (Reardon & Berdegue, 2002). Jiang (2009) regards it as an innovation enabling the distribution of agri-products in China. With respect to its possible effects, S. Zhang & Li (2010) argue that the implementation of FS-docking program can effectively resolve the selling difficulty for farmers, reduce farmers' risks resulting from information asymmetry and thereby ensuring their income. Hu (2010) highlights the benefits brought by FS-docking for farmers' co-ops in terms of economics, quality, technologies, and management. Ma (2010) analyses its contributions to supermarkets, including the guarantee of food safety, freshness improvement, and enhanced competitiveness of supermarkets. Lin (2010) applies the DEA method to evaluate the overall performance of FS-docking, and identifies its effectiveness, feasibility and superiority based on an empirical study.

In China, the FS-docking program has been put into practice since it was firstly proposed in 2007. From then, the Ministry of Commerce of China officially began to launch a pilot project carrying out FS-docking in some regions. Moreover, directly benefits about 110,000 farmer members of co-ops, special funds were provided to support 205 pilot programs involving 17 provinces. Both central and local governments have issued a series of guidelines for the practical work. In particular, FS-docking is considered as a strategic plan in the public document issued by the central government every year. These pilot projects have proved the effectiveness of FS-docking. It benefits

three major stakeholder groups including farmers, consumers, and supermarkets with the facts mentioned in the following examples:

(1) Example of Beijing city

About 380 supermarkets and stores have participated in FS-docking in Beijing city till 2011. Cooperating with more than 120 country-wide farmers' co-ops, these supermarkets and stores cover 8 brands such as Wumei, Jingkelong, Carrefour, Huatang, Yonghui. Among which, the participation experience of Carrefour stated that the shipment time of agri-products reduced from 5-6 days to 1-2 days bringing a reduction of 15-20% in cost directly. As a result, such participated supermarkets offer 15-20% cheaper retail prices of agri-products than open fairs.

(2) Example of Linyin city

The promotion of FS-docking program in Linyin city (in Shandong Province) contributed to an average 13% reduction in distribution cost. At the same time, the procurement prices offered by supermarkets are averagely 5% higher than "field selling" levels.

(3) Example of Jianxiang town

Jianxiang town is one of China's largest rich lands of garlic. Due to the promotion of FS-docking, the average price of the garlic procured from farmers there are 0.4 ¥ /kg higher than other markets. Moreover, supermarkets will return 30% profits to the cooperated farmers, meanwhile the consumers gain 10-15% reduction in retail prices as a result of the elimination of middlemen.

Bottlenecks of logistics in FS-docking

Smooth FS-docking leads to an integrated APL approach having profound effects toward sustainability. At present, APL in China is experiencing a significant transformation to a more direct connection between producers and consumers, with the purpose of phasing out the traditional logistics model with a raft of middlemen. Today only a very small amount of farmers have joined the FS-docking, and 25% of the agri-products in supermarkets are supplied by this way. It is clear that there is still a long way to go to the large-scale implementation. The big gap in FS-docking is drawing too much attention. In particular, the aspect of logistics becomes a focus point. In view of numerous practical cases, it can be found that the logistics sector for smooth FS-docking urgently needs the engagement of professional logistics providers. However, most 3LPs

in China are small and medium sized as well as they commonly lack core competencies when facing the increasing requirements from markets. Figure 7-12 describes three scenes of APL development in China (Agronet, 2013).

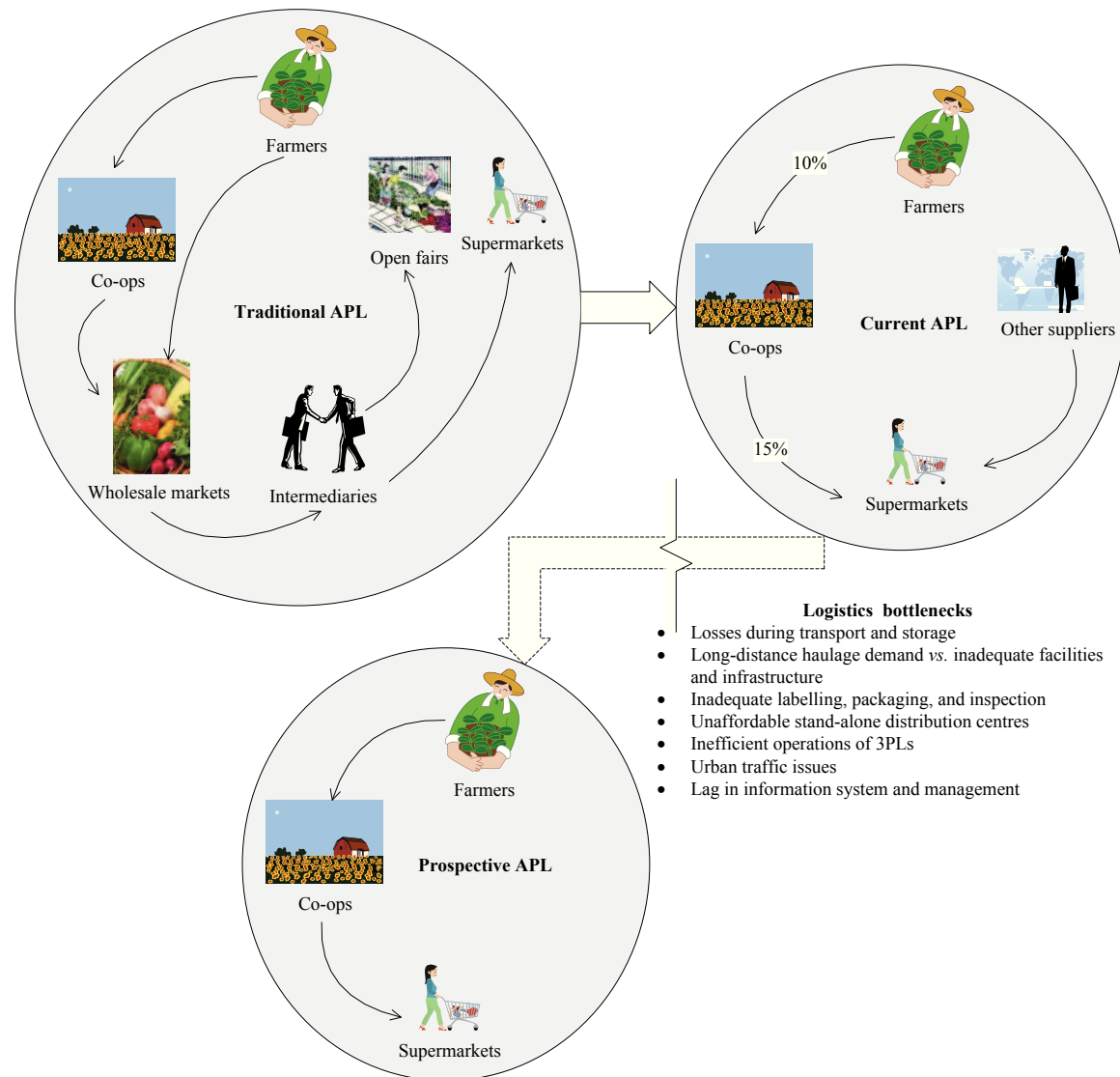


Figure 7-12 Bottlenecks of logistics in implementing FS-docking

The first scene shows the traditional APL involving too many middlemen; open fair and traditional wholesale markets play a big part. Now the situation is changing to the second scene. Some farmers and their cooperatives and supermarkets are increasingly going into collaboration. However, there is only about 10% collaboration between individual farmers and cooperatives; and about 15% collaboration between cooperatives and supermarkets. There still seems to be a long way to realize the prospective scene where FS-docking is implemented as much as possible. This research identifies a list of

logistics-related barriers to the success of FS-docking which block the way to maximal FS-docking.

(1) Losses during transport and storage

Farmers' co-ops often encounter rejections from supermarkets due to the unsatisfactory quality of their products. The loss during transport and storage causes most of the rejections resulting from improper temperature controlling or the rind damage.

(2) Long-distance transport demand vs. inadequate facilities and infrastructure

Many FS-docking cases have to be limited within nearby areas because of inadequate transport facilities especially the refrigeration capability. However, the agricultural production geographically differs from regions to regions. It is common that the supermarket purchase nonlocal agri-products and this leads to huge demand for the long-distance transport. Nevertheless, the status quo of inadequate logistics facilities and infrastructure greatly hinders this requirement.

(3) Inadequate labelling, packaging, inspection

Ideally all agri-products supplied to supermarkets are required to be labelled with the name and address of the producers. Thus, it can assist supermarkets to provide information about the agri-products to their clients. In reality, many farmers and their co-ops are not able to meet the requirements of bar code and labelling. In addition, the improvement of packaging on agri-products can increase the profitability for farmers and also address the difficulty in sorting for supermarkets. Standard quality inspection, classification, labelling and packaging jointly enable the food safety guarantee for supermarkets and grocery stores.

(4) Unaffordable stand-alone distribution centres

The majority of the farmers' co-ops cannot offer logistics facilities especially refrigerated warehouses and vehicles, which becomes a barrier to the APL development. In addition, due to the relative short history of supermarkets in China and capital shortage, many small and medium-sized supermarkets do not have their own stand-alone distribution centres.

(5) Inefficient operations of 3PLs

Regarding the operation of most 3PLs, usually they compete for the market share heavily relying on lower prices instead of service quality improvement. To achieve the utility maximization in distribution, a set of specialized technologies and knowledge is required to optimize the planning and overall arrangements. This is also the essence

differentiating “distribution” from “delivery”. Besides, the improvement of personnel skills and abilities are necessary to enhance the overall service level.

(6) Urban logistics issues

As previously mentioned, most cities in China face traffic congestion and air pollution. A mass of deliveries take place in inner cities daily, and insufficient off-street parking aggravate the two problems. Urban logistics often contain the “ends” of supply chains known as the “last mile delivery”. FS-docking usually requires a constant daily supply, thus there seems few possibilities for reducing goods flows into cities. Frequent and separated goods movements inevitably cause traffic congestion, GHG emissions and shipping costs. Accordingly, consolidated shipment is required to cope with such issues.

(7) Lag in the information system and management

FS-docking relies on the order management capabilities. Effective information transfer offers market quotation (e.g. supermarkets demand) which potentially guide farmers’ production. In addition, information management acts as a key enabler for APL. The lag in information equipment and technology hinders the efficient cooperation between farmers’ co-ops and supermarkets. Such information system and technologies should be widely adopted including digital terminal equipment, bar code technology, RFID technology, point-of-sale system, and electronic ordering system, etc.

Regarding the identified logistics bottlenecks, incorporating agi-FVs into FS-docking can be one of the effective solutions at present. To support this view, Table 7-4 gives an overview of FV functions in response to such bottlenecks.

Table 7-4 Breaking the logistics bottlenecks with (agri-) FV’s functions

(Agri-) FV functions	Breaking logistics bottlenecks
Offer an attractive environment for 3PLs and 4PLs	☐ Inefficient operations of 3PLs
Provide basic logistics services and auxiliary services	☐ Inadequate labelling, packaging, inspection ☐ Inefficient operations of 3PLs
Shared access to the infrastructure, facilities, equipments	☐ Unaffordable stand-alone distribution centres ☐ Lag in the information system and management
Synergy relationships among companies	☐ Inefficient operations of 3PLs ☐ Urban traffic issues
Provide a interface between the transshipment of long-distance traffic to urban “last mile” delivery	☐ Urban traffic issues
FV as a key investment project in China	☐ Unaffordable stand-alone distribution centres ☐ Losses during transport and storage
Intermodal terminals that are connected to freight corridors	☐ Long-distance transport demand vs. inadequate facilities and infrastructure

7.4.1.2 Agri-FV types

Basis of FVs – retail distribution centres

Before introducing the types of FVs partnering in the FS-docking in China, “retail distribution centre” will be firstly analyzed which is regarded as the basis of FV. Normally a distribution centre is described as a single location with warehouses or other specialized buildings to stock a vast number of products, also often with refrigeration or air conditioning (Tongpang & Praneetpolgrang, 2011). In general, a distribution centre exhibits three functions including storage, processing, and distribution of goods for wholesalers, retailers, or consumers.

In practice, distributions centres built by retailers, wholesalers, 3PLs, and cooperative enterprises are common during in the past. With regard to the consolidated function, this research investigates a combined retail distribution system of Seven-Eleven Japan (SEJ).

Combined distribution originates from the success of Seven-Eleven Japan (SEJ). Seven-Eleven is the international convenience-store chain. Primarily operating as a franchise, it is the world’s largest operator, franchisor and licensor of convenience stores (Wikipedia, 2013a). Convenience stores like 7-Eleven are characterized by frequent purchase in small amount, but they usually have no their own storage spaces and facilities. In the past, one wholesaler in Japan usually limited his business to a certain manufacturer’s goods. Wholesalers delivered goods to their client retailers separately, which probably caused inefficiency and uncertain delivery time. As a result, convenience stores’ needs for frequent purchase in small amounts could not be met. In order to break through the dilemma, SEJ reformed the supply chain through cooperating with contractual wholesalers and manufactures. This problem was solved after the first transformation of wholesalers’ business scope and the creation of distribution centres. The assigned wholesalers are designated to supply different manufacturers’ products for multiple areas. Under this background, wholesalers prefer to establish distribution centres by self-raised funds, so as to profit more by improved delivery services. Managed considering the SEJ’s guidelines, clustered wholesalers used the same logistics system offered by combined distribution centres. From then, the concept of distribution centre with the purpose of offering combined logistics preliminarily took shape. The second major transformation was that SEJ established their own combined distribution centres to reduce costs and delivery time. With the construction of stand-alone combined

distribution centres, SEJ was able to daily deliver fresh-prepared foods to the sales territory.

Since 1796, SEJ has been developing a streamlined distribution system to efficiently integrate products suppliers. Thus, a combined delivery system was created to allow products from different suppliers to be loaded on the same trucks to the SEJ's stores (Negayama & Weill, 2004). Today, SEJ's combined distribution system is operated by 3PLs. To facilitate the efficient delivery of fresh products, temperature-separated distribution is an important element. Foods belonging to the similar temperature range are consolidated to be shipped, which contributes not only to the efficiency of delivery but also the reduction of vehicle emission and traffic congestion.

Figure 7-13 describes the information-based temperature-separated food distribution of SEJ, offering logistics advantages for customers, franchised stores, and suppliers (Holdings, 2012).

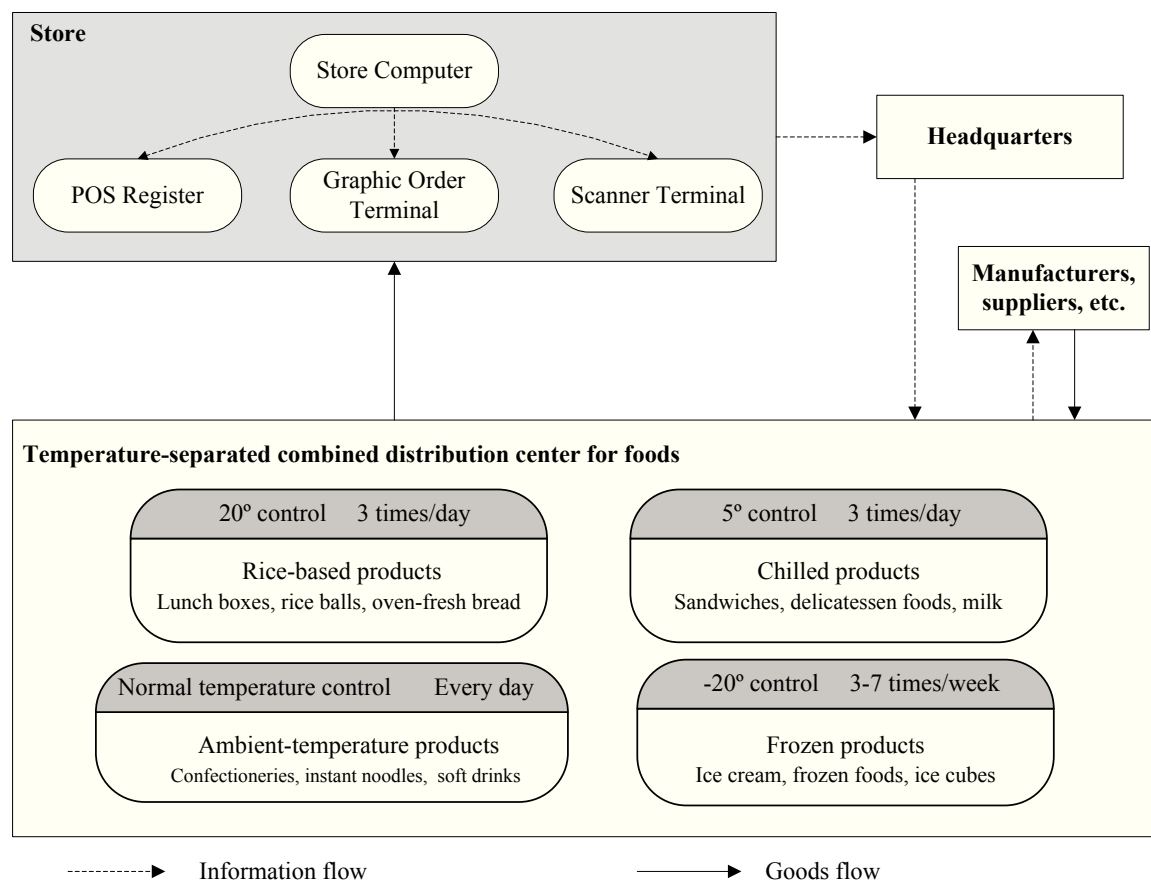


Figure 7-13 Information-based temperature-separated food distribution of SEJ

In a store, the store computer connects POS Register, Graphic Order Terminal, and Scanner Terminal. POS Register store and transmit sales data when sales transactions occur; Graphic Order Terminal places orders; Scanner Terminal is used for product

check-in, registration of product display positions, and freshness control. Store Computer contacts headquarters to place orders. Headquarters will transmit the received orders to the distribution centres through the information system. Distribution centres group these orders in preparation for the delivery. If the stocks of required products are in short, distribution centres will contact their suppliers and manufactures for the replenishment. Foods are then delivered by temperature-separated trucks. They are shipped separately according to different temperatures levels including chilled temperature (-20°), refrigerated temperature (5°), uniform temperature (20°), and ambient temperature.

Wal-Mart, a global retail giant, also has been implementing temperature-separated distribution. The difference is that distribution centres of Wal-Mart are self-built, while 7-Eleven outsources the distribution operation to the third party. Combined distribution centres are established depending on their purposes and economic strength. Basically there are three kinds of combined distribution centres:

- (1) A distribution enterprise builds a combined distribution centre serving a number of retailers;
- (2) A number of retailers jointly build a combined distribution centre for themselves;
- (3) A cluster of distribution enterprises collaboratively build a combined distribution centre for sharing facilities to serve retailers by region.

Types of agri-FVs

Regarding the functions of centralized information management and consolidated logistics, this research proposes three types of agri-FVs to close the gap in FS-docking. They are general FVs with APL capability, transformation of suitable wholesale markets, specialized FVs purely serving APL.

(1) General FVs with APL capability

As discussed previously, FV projects in China are experiencing the expansion. What's more, central and local governments place much attention on FVs construction since 1998, which offers opportunities for their implementations in APL. Thus, in the existing general FVs, the provision of services and facilities stretching to APL can facilitate better FS-docking. Concerning the special needs of APL, general FVs who are willing to engage in APL are required to offer some necessary logistics services and facilities. For example, chilled and frozen meat products require an uninterrupted cold chain during storage and transportation. In view of this special need, providing cold storage areas and vehicles with proper refrigeration equipments should be considered.

A representative of this type is ***Sungang Qingshui River FV***, located in Shenzhen which is a major city in the southern China's Guangdong Province. It is a comprehensive FV serving a host of commercial fields, e.g. building and decoration materials, arts and crafts, home appliances, electronic component, auto parts, and agri-products. The inside procurement centres and distribution centres for agri-products lead to its pivotal position in serving the consumption markets of Shenzhen city and Hongkong. In this example, Sungang Qingshui River FV is a general FV with APL capability.

(2) Transformation of suitable wholesale markets

This kind of FVs has been explored in China for several years. The gradual transformation of suitable wholesalers markets to agri-FVs is a national project promoted by the Ministry of Commerce of China since 2006, namely "Double Hundred Markets Program". This project aims to reform 100 pilot large-scaled wholesale markets especially to improve their logistics services; and to support the capacity building of 100 pilot large-scale enterprises engaging in logistics, processing, trading of agri-products.

The major supportive guidelines for the "Double Hundred Markets Program" are: (i) guide agricultural wholesale markets to build distribution centres, trading hall, warehousing, integration of domestic and foreign trading centres, and other infrastructure; (ii) encourage agricultural wholesale markets to equip with inspection and testing department, information centre, surveillance and security mechanism, waste and sewage treatment system, settlement management division, and independent fully enclosed livestock slaughtering area; (iii) assist large-scale enterprises and 3PLs engaged in agri-products circulation to establish freight terminals; (iv) facilitate the cold chain development; and (v) support the implementation of FS-docking programs in adaptable farmers' co-ops.

The transformation of wholesale market strengthens interactions between producers and markets with efforts in logistics services enhancement. ***Jingzhou Lianghu FV*** is one of the successful cases relating to the transformation of wholesale market. With a total investment of 480 million CNY and a coverage area of 608 acres, nowadays it is able to provide services including inspection and testing, cold storage, distribution, e-commerce, information networking, and additional agro-business services. Jingzhou Lianghu FV leads to an efficient and organized marketing system covering vegetables, fruits, grain, oil, non-staple foods, aquatic products, poultry, agricultural materials and machinery, etc. Furthermore, the traditional transaction process of agri-products becomes more

convenient following the electronic procedure: input electric data of buyers and sellers – weigh traded products – trade with electronic card – settle accounts via the clearing platform. The co-location of 3PLs is formed, thereby attracting numerous trading of agri-products. Besides, it has significantly improved the service quality and freight capability.

(3) Specialized FVs purely serving APL

Specialized agri-FVs purely serving APL are usually located in major producing areas or near large cities. From the effective logistics management point of view, specialized agri-FVs are required in response to the orientation of economies of scale. All the infrastructure, facilities, structure, and service items are designed and invested according to APL's characteristics. Such kind of FVs brings substantial cost savings, due to large volumes of goods can be stored, processed, and shipped. Besides, specialized agri-FVs are able to offer streamlined logistics services such as commodity inspection, packaging, primary processing, and distribution. Additionally, they make possible investments in electronic and information infrastructure which cannot be afforded by many small transport and warehousing companies. They contribute to the supply chain management of agri-products from a regional or country-wide perspective. They are necessary for realizing promotion programs related to the agriculture sector development. In short, specialized agri-FVs provide synergies of the logistics-related processes in support of the large-scale production and marketing of agri-products.

Higreen agri-FV represents one of the newly established advanced agri-FVs in China. It is a key construction project supported by Shenzhen municipal government and put into use since 2011. Higreen agri-FV is located in the suburb 12 km from the Shenzhen city centre and 25 km from Hongkong city centre, featuring abundant highway links and railway connections. It covers 74.13 acres with a total investment of 18 billion CNY, focusing on the agri-products supply. Nowadays, vegetables, fruits, frozen foods, dry foods supplied by Higreen agri-FV respectively account for 85%, 90%, 90% and 60% of the consumption of Shenzhen residents. Besides the local retailers, other retail business in neighbouring Dongguan city and Huizhou city also buy agri-products from Higreen agri-FV.

Currently Higreen agri-FV has emerged as one of the busiest APL platforms in southern China. It stands for a shift to “green”, safety, and efficient logistics operations as well as an enabling environment for the agribusiness. Its daily transactions nearly

double compared with the Buji Farm Produce Wholesale Market, which was replaced by Higreen agri-FV since 2011. Buji Farm Produce Wholesale Market, operated from 1989, once was regarded as the biggest “shopping basket” of agri-food in Shenzhen. With Shenzhen’s rapid economic development and the expansion of urban population during the past 22 years, the limitation of operation area, aging infrastructure, and traffic congestion resulted in an overload operation situation. As a result, it was unable to meet the rising consumption demand of nearly 20 million residents in Shenzhen and Hong Kong. In particular, it eventually could not survive due to the traffic congestion and the inside parking shortage. Facing such tough situations, a more proper site with professional logistics services provision for agri-products was urgently needed for Shenzhen. Higreen agri-FV project was created to get out of difficulties mentioned above. Meanwhile, prices of traded goods there were 8% lower on average because of an abundance of products (Han, 2011).

There are trading zones, processing and distribution zones, storage areas, and commercial centre in Higreen agri-FV. In addition to the provision of logistics services and additional services for the agri-products trading, it has two distinguished features concerning the food safety control and sustainability trend.

1) Innovation and electronization of food safety control

A third party laboratory is established to test a variety of pesticide residue independently, which is a front-runner in the domestic field. This laboratory offers a series of solutions to ensure the agri-products safety involving inspection, consulting, and training. In addition, the technology of “risk map of agri-products safety” has been developed to strengthen the ability of risk warning. Data relating to the records of involved products, quality inspection and testing are stored in a database. Through dynamic updating and classification retrieval of this database, information with the description of regions, varieties, and time are marked on the electronic map. Food safety risk map has two main functions: (i) transfer data between production and marketing; (ii) identify potential food safety risks, and timely provide feedback for the original producers so as to take preventive measures. If the unqualified products are recognized, the related information will be presented on the risk map. And then, the retailers who hold such goods will be informed. In addition, the early warning report is shared with government regulatory agencies in support of their management efficiency of agri-products quality assurance. Risk map provides agri-products safety information for all participants in the

supply chain with such a visual method. Moreover, Higreen agri-FV applies RFID and IOT into its traceability system. Transactions are settled with electronic cards and therefore the source of agri-products can be traced if food safety problems occur (Han, 2011).

2) Sustainability orientation and CSR

First, pedestrian and vehicles are separated and vehicles should not enter into operating zones. Eco-friendly battery cars are used to avoid secondary pollutants on agri-products. Second, well-organized logistics arrangements and proper distance between inside buildings enable the time saving of transaction. This leads to the freshness and quality assurance of agri-products. Third, wastes generated in the FV are compressed to be sorted, recycled, and carried out. Higreen agri-FV is going to cooperate with Guangzhou Institute of Energy Conversion and Chinese Academy of Sciences for long-term sustainability advantages. Environmental projects such as sewage treatment station, bio-waste disposal, and organic fertilizer production lines are proposed to be launched.

It is worth noting that specialized agri-FVs can play an important role in China's APL development. They will meet the requirements relating to the food safety and reduction in negative externalities. Additionally, the development of innovative, eco-friendly and energy saving technologies can highly facilitate the sustainable advantage of agri-FVs.

7.4.1.3 Operating mode

The general operating mode of an agri-FV involving in FS-docking is depicted as Figure 7-14. The premise is that the three major parts including farmers' co-ops, agri-FVs, and supermarkets/stores are associated with each other under cooperation agreements. That is to say, the three parts know each other more or less and agree to engage in the cooperation of supplying agri-products.

The operating mode fully relies on the information exchanged between producers and supermarkets/stores. In which, the agri-FV plays an essential role in information processing, storage, and dissemination. The demand order flows from supermarkets to agri-FVs, and such information is then gathered and processed. If the on-hand inventory in the agri-FV can afford the demand order, the delivery task will be scheduled and then executed. The operating mode emphasizes the consolidated delivery to supermarkets/stores in need of purchasing. To quickly response to the market demand, the

information about inventory in the agri-FV is offered to related supermarkets/stores. Besides, the delivery task is carried out and meanwhile the information about upcoming distributions is sent to supermarkets/stores. Mobile electronic devices will pass the delivery and trading information to the agri-FV when every delivery task is done.

If the demand order cannot be scheduled at once for the on-hand inventory shortage, normally the agri-FV will contact farmers' co-ops with combined orders. In this case, these farmers' co-ops will organize their farmer members to prepare for the orders. The combined orders lead to consolidated procurement, which is similar to the consolidated delivery. More promisingly, the consolidated procurement can reduce unnecessary trips from farms to agri-FVs, thereby cutting the logistics cost for buyers. The demand orders from multiple supermarkets/stores are combined by the agri-FV in two cases: (i) ordering the same kinds of products without special requirements on the origin; (ii) products ordered are different kinds but can be acquired from the same or adjacent producing regions. In addition, farmers' co-ops provide their production information to the agri-FV, which facilitates the fast searching for suitable suppliers according to their requests.

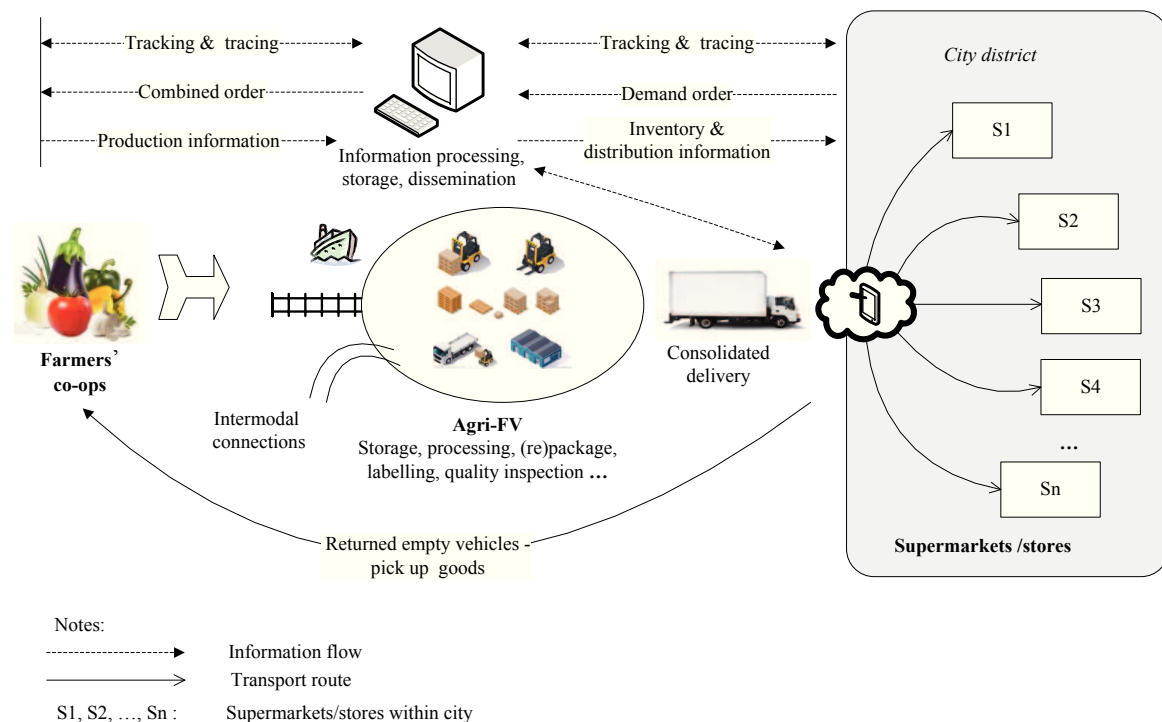


Figure 7-14 General operating mode of an agri-FV involved in FS-docking

The bi-directional information flow across the whole logistics chain supports the tracking and traceability. This probably leads to a transparent database with the complete information about these agri-products, such as agricultural production, storage,

distribution management, processing, and selling. The tacking & traceability system at least consists of labelling system, data storage system, data acquisition & transmission system, and information inquiry system. So far a variety of technical methods have been developed in building tacking and traceability system for food, e.g. GPS, bar code, HACCP, and the combination of RFID and bar code.

It is worth noting that the transport vehicles may travel to the nearby farmers' co-ops to take delivery of goods according to the restocking order, rather than immediately return to the agri-FV with empty freight. This solution helps to make full use of transport vehicles and reduce the transport cost per unit.

7.4.2 Channel II: farmers' co-ops + agri-FVs (dry ports) + export

An important sub-channel of APL is exporting. Over the years, agricultural export has played an important role in the following aspects:

- Promote rural employment

Agricultural export leads to the job creation in sectors of agriculture, manufacturing, and related services. It was estimated that every \$ 10,000 of agricultural exports could directly and indirectly provide about 20 jobs.

- Increase farmers' income

In China, most of domestic agri-products are facing oversupply. However, generally international agricultural export brings much potential for the agri-products market. Consequently, it has become a major source of income for local farmers in some major producing regions.

- Facilitate agricultural development

In order to adapt to the international market requirements especially the green standards, export optimizes the production varieties, quality, logistics, and brand standards of agri-products. Besides, it can optimize the agricultural industry structure and improve international competitiveness of agri-products as well as drive the development of related domestic industries.

Usually processing is necessary before exporting. Proper processing reacts to the problems such as marketing for remote regions and non-seasonal products supplies. It can increase agri-products' added value, resource use efficiency, and competitiveness at export markets. Export processing enterprises, 3PLs, and international freight forwarding agents are involved.

Agri-products export brings sustainability of farm producing with respect to: (i)

economic sustainability, e.g. farmers' income; (ii) social sustainability, e.g. job creation, drive of associated industries, narrow the wealth gap between poor and richer regions; (iii) ecological sustainability, e.g. improved green standards concerning pesticide residue, heavy metal, and radioactive substance.

Yet, with ongoing export in the agricultural sector, the demand for convenient logistics infrastructure and integrated export procedures will continue to rise for years in China. Streamlined logistics process with administrative provisions for customs and other inspections thus are required for more efficient handling of agri-products export. In response to this, development of a network of dry ports can greatly help to streamline the logistics chain (ESCAP, 2010).

A dry port refers to a “customs clearance depot located inland away from seaport(s) giving maritime access to it” (UNCTAD, 1991). It “provides services for the handling and temporary storage of containers, general and/or bulk cargoes that enters or leaves the dry port by any mode of transport” (UNCTAD, 1991). Dry ports have the similar functions as those of sea ports, and can also provide customs-related services and other services, e.g. inspections of cargo export and import. The development of dry ports and especially the connection of different transport modes can highly promote the agri-products export in hinterland areas.

Dry ports can be differentiated among those that are based on inland container depot, FV, hinterland port, economic zone, and traffic terminal. Considering the features of APL, a series of conditions are required, including intermodal connections and logistics functions (e.g. cold storage, sorting, packaging, labelling, light manufacturing, food processing, and inspection). The channel of “farmers' co-ops + dry ports + export” is more likely to implement FV-based dry ports for meeting the conditions mentioned above. Other types of inland container depot/hinterland port/traffic terminal-based dry ports are not able to provide sufficient logistics services beyond transport and transit shipment. In addition, economic zone-based dry ports focus more on the strength of commercial transaction and technology. Among these kinds of dry ports, FVs can perform as more attractive logistics nodes through adding a number of seaport functions (e.g. customs clearance and other inspections) in align with export. Such dry ports enable the shippers to more conveniently clear cargoes, process, and deliver documents. Clients do not have to go through related formalities at seaports, since they can be done just within FV-based dry ports.

FV-based dry ports contribute more value to agri-products especially to the export.

The importance of after-harvest preserving and processing are gaining much attention in China, thereby adapted logistics operations are needed to meet such requirements. FV-based dry ports can not only fill the operational gap, but also generate the export economic growth and employment.

Xi'an dry port is a perfect example of FV-based dry port approved by the State Council and put in to use since 2010 on. It is located in Xi'an City - the principal city and current capital of Shaanxi Province. Shaanxi Province is well-known for the production of a wide variety of fruits. Its apple production accounts for one-eighth of the worlds' apple output and one-third of China's total apple output. As one of the key projects of the provincial "11-th Five Year Plan (2005-2020)", Xi'an dry port undertakes the mission of promoting international trade of the city and its surrounding cities especially west China regions though extending seaports gates. Shaanxi is neither near the border nor alongside sea, thus the extension of its export-oriented apple market has been limited by inconvenient export access and high transport cost. For a long term, Shaanxi's farmers especially orchardists had been looking forward to set up a convenient and efficient international trade channel. Xi'an dry port enjoys a critical transport node at the geographical heart of China. It is a tri-modal dry port connecting several highways, railways, and airport. Thus, extending seaport's functions to Xi'an is a precondition for the promotion of fruits exports. To fulfil the dry port's ambitions in functioning as a seaport, the committee of Xi'an dry port has initiated the cooperation with seaports from the starting phase of its construction. Both Lianyungang Port Authority and Qingdao Port Authority are involved in the cooperation with Xi'an dry port. These seaports provide technical and management support, which aim to shorten transport distances by consolidating consignments to/from western China (Beresford, et al., 2012). Today this dry port offers the services with the joint efforts of a bonded FV and seaports, including intermodal transfer, customer clearance, international and domestic forwarding, value added services and bonded warehousing. Moreover, with the huge investment in the railway container centre, railway becomes the major transport mode. Connecting Xi'an dry port and its partner seaports, the railway contributes to 75% of the export. This brings an average of 10-20% reduction in the container shipment cost. In particular, a special train has been launched with the purpose of serving the export of Shannxi apple juices. These apple juices are shipped to Rotterdam Port, and this "trip" becomes quite efficient for the convenient custom procedures which can be done within Xi'an dry port.

In addition to the two major channels for APL development in China, there are

various additional direct marketing methods whereby farmers sell their products directly to consumers, e.g. direct supply to local supermarkets/stores, selling at farmers markets, on-farm retail markets, and roadside stands. FVs are not requisite in these additional direct marketing channels due to the short-distance shipping or temporality. In such cases, the provision of agri-products is usually self-sufficiency within local areas. This research does not discuss these additional distribution channels due to their limited functions and inadaptability regarding most requirements of markets.

7.5 KM approaches to agri-FV project planning and operating

In order to build and use agri-FV projects toward sustainability in China, KM approaches are applied in both the planning stage and operations. Although APL differentiates itself from the general goods logistics, the main planning process, basic infrastructure, and operational activities of them can share some general methods.

7.5.1 KM approach to agri-FV project planning

On the basis of KM approach to general FV project planning in Chapter 5, the planning stage of an agri-FV project is organized following the route of “sense making, knowledge creation, and decision making” (see Figure 7-15).

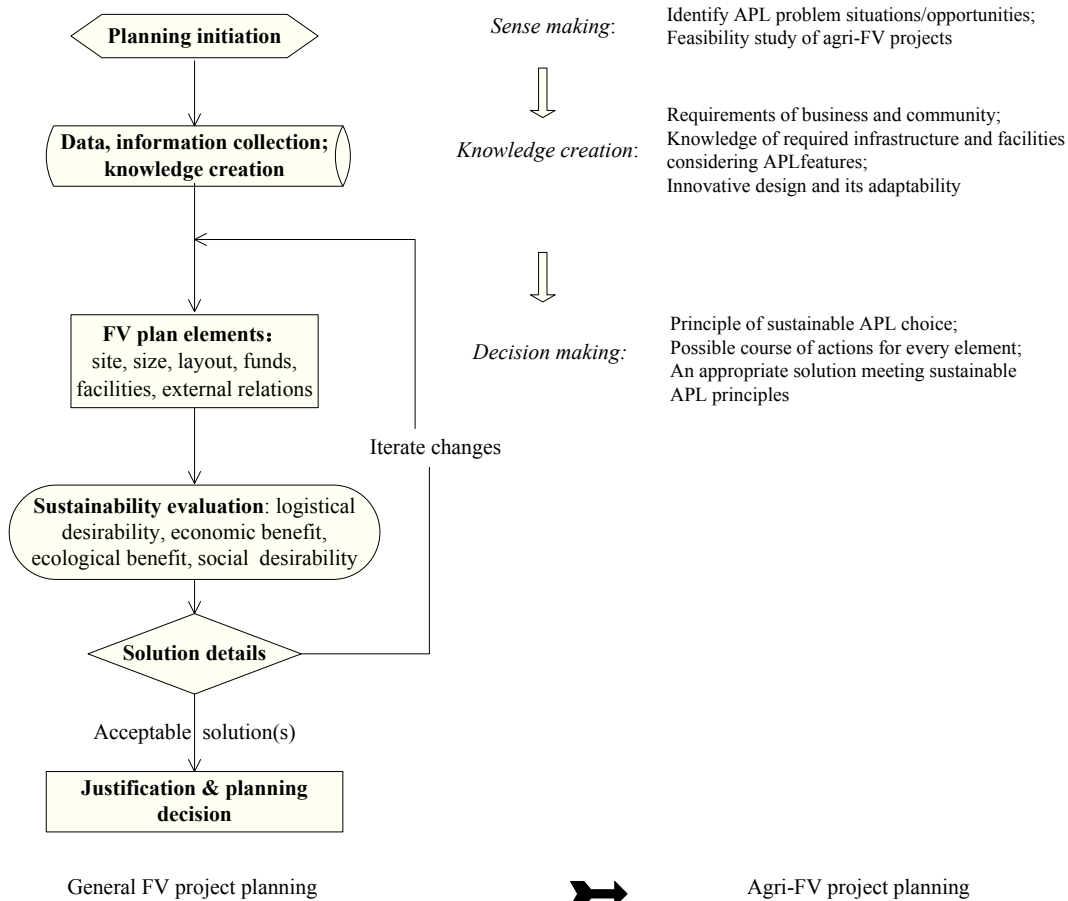


Figure 7-15 KM enabled planning process of an agri-FV project

In detail, the planning process of an agri-FV project consists of the following activities:

(1) Sense making

Sense making focuses on helping objectively perceive APL problem situations and the development opportunities. It also serves as a guide for conducting adequate and meaningful feasibility study of proposed agri-FV projects.

APL problem situations are mainly concluded into such aspects in today's China: farmers' difficulties in selling; postharvest loss caused by improper handling, transport, storage and marketing facilities; instability (i.e. increase) in retail prices resulted from a host of intermediaries; urban traffic congestion generated by frequent deliveries in small-lot quantities; lack of integrated information system for tracking, tracing, and order management; inadequate processing capacity; unsuitable labelling and packaging; less competitive exports especially in inland regions due to the expensive transportation and inconvenience in export procedures.

APL development opportunities can be found in such meanings: (i) balance

geographically variable farm producing, (ii) uphold the supply-demand balance of agri-products marketplace, (iii) increase farmers' revenue with value added products, (iv) strengthen competitive position of agri-products in international markets, (v) job creation for the rural surplus labour and, and (vi) agri-food safety guarantee.

As mentioned in Chapter 5, the feasibility of an agri-FV project lies on the co-determinants including adaption, necessity, and possibility. First, regarding agri-FV projects, the purpose of considering “adaption” is to respond to APL development trends at both international and regional levels as well as the transformation of agriculture industry. “Adaption” can be analyzed with the consideration of macroeconomics and policy environment. In many developed countries, major changes in the freight transportation industry, intensive use of containers, and new logistics infrastructure investments have facilitated the efficient movements of agri-products with the reliability at competitive prices. What is more, shifting from the shortage to abundance of agri-products, improvements in agricultural operating environment have stimulated modern APL development in China. In the past, agricultural stakeholders merely focused on the increase in outputs. In recent years, they began to pay attention to the efficient logistics activities after the harvest, so as to reduce loss, guarantee food quality and safety, as well as protect the interest of both producers and consumers. The APL networking driven by logistics nodes is a growing concern in agri-products trading, which calls for agri-FVs and coordination effects in the networking. Furthermore, China's “Go West” strategy (launched in 2000 by the Chinese Central Government) needs more logistics nodes established in western China for market expansion; the “FS-docking” pilot project (launched in 2006 by the Ministry of Commerce and the Ministry of Agriculture) promotes the agri-products to be supplied directly from farmers and their co-ops to supermarkets or other retailers. The economies of scale in logistics operations enabled by professional logistics and transport providers are thus required. Second, the consideration of “necessity” aims to help cope with problems that APL faces. As previously discussed, the Higreen FV project was created under huge pressure from traffic disturbance and congestion in the streets which were adjacent to the former wholesale market in Shenzhen city. Opportunities in developing APL also “convince” that an agri-FV project is a necessity. Xi'an dry port is an example of why APL opportunities could necessitate a new FV project. Third, “possibility” relates to the potential supports in terms of physical conditions, human resource, financial sourcing, market potentials, and policy support, etc. They may be: local agricultural productivity, agri-products consumption of residents in

local or adjacent areas and their consuming habits, sales status of local supermarkets, labour force employment, possible investors and 3PLs. For example, the “Double Hundred” program (launched in 2006 by the Ministry of Commerce and the Ministry of Finance) offers special funds to support the construction of agri-FVs updated from traditional wholesale markets and boost 3PLs development. This leads to smooth distribution channels of agri-products supply. In addition, the national program of “Adjustment and Revitalization Plan of the Logistics Industry” (launched in 2009 by the Chinese Central Government) attaches great attentions to 9 kinds of projects in the logistics sector including APL, FV project, and city distribution, etc. If the proposal of a new agri-FV project fulfils above three aspects, it will go into the next step - knowledge creation.

(2) Knowledge creation

The knowledge creation process is interacted among planners and environments (local residents, retailers such as supermarkets, stores or shops, suppliers including local farmers and farmers’ co-ops, potential non-local suppliers). Nonaka, et al. (2000) propose the SECI model to explain knowledge creation processes as comprising “socialization”, “externalization”, “combination”, and “internalization”. These processes generate experiential knowledge, conceptual knowledge, systemic knowledge, and routine knowledge through the conversion between tacit and explicit knowledge.

Experiential knowledge includes judgment, know-how, and commitment of individual planners. Planner members with established routine knowledge accelerate their accumulation of experiential knowledge by moving between agricultural production sites, visiting retailers, interacting with existing agri-FVs, and communicating with local residents. Thus, they can build their experiential knowledge by shared work and other life experiences. On the one hand, planners acquire experiences about consuming and supplying of agri-products. On the other hand, by interacting with existing agri-FVs, planners accumulate experiences relating to site selection, layout design, buildings and infrastructure requirements. Additionally, local residents’ opinions are highly relevant to the success of an agri-FV project. This is due to that such opinions largely mirror the frequently cited concerns such as safety and quality of agri-products, urban traffic congestion, and living space. Meanwhile, individual planners with different backgrounds share their experiences concerning logistics facilities and technology, agri-products sources, potential customers and cooperation issues, etc.

Then such experienced planners start to articulate some of the concepts which express their tacit understanding by the use of metaphor, analogy, and model. They may articulate the strategic position mainly based on the opinions of local residents, farmers and retailers. Moreover, the experiences about consumption and supply of agri-products could be converted into clear concepts, e.g. the demand for agri-products, consumption rate, peak consumption or demand, categories of supplied agri-products.

Systemic knowledge is visible, tangible, and content-oriented, which is generated by bringing together both the information from internal and external sources. They may be the scale, site, necessary facilities and infrastructure (refrigerated warehouse, transport mode connection), integrated information system connecting farmers' co-ops and supermarkets, planning manuals, documented and packaged information about supermarkets and farmers' co-ops, farmers.

Routine knowledge is referred as tacit knowledge embedded in any element of the agri-FV project plan. The ideology of planner team is included in the routine knowledge. For example, if the planner team regards sustainability effect as an orientation of the agri-FV project, the overall plan that they make will comply with this principle, such as proper land using, low-emission and green energy warehouse, food traceability systems, fast channel for pollution-free agri-products.

(3) Decision making

The components of an agri-FV project plan and related approaches can mainly refer to general FV project planning process which has been already discussed in Chapter 4. It is worth noting that the function zones should be designed in line with APL requirements. In decision making, the target position of agri-FV projects differs from general ones (see Table 7-5).

Table 7-5 Target positioning of agri-FV projects

Stakeholders	Target positioning
Government	<ul style="list-style-type: none"> - Provide infrastructure and services for APL - Reasonable land use - Alleviate the traffic congestion and air pollution - Job creation - Promote economic growth
3PLs	<ul style="list-style-type: none"> - Reduce logistics cost - Shorten logistics time - Economies of scale, professionalization
Retailers	<ul style="list-style-type: none"> - Logistics outsource for the cost reduction - Quick response - Reliability - Adapted packaging, processing, storage - Cheaper purchase prices
Farmers' co-ops	<ul style="list-style-type: none"> - Long-term stable cooperation with retailers - Knowing market information - Increase added value and the expansion of overseas market
Customers	<ul style="list-style-type: none"> - Stable and affordable retail price - Safety and quality guarantee of agri-foods

7.5.2 KM application in operating agri-FVs

Regarding the operations in an agri-FV, KM is committed to: (i) creating a knowledge environment from the perspectives of conceptual shift, standards building, farmers' education and information networking, (ii) connecting knowledge to operating and management, and (iii) sustainability check.

7.5.2.1 Creating a knowledge environment

Knowledge environment is a container of social practices, technologies, and physical arrangements for facilitating knowledge building. It is regarded as a connection between people and knowledge in a broad sense (Kariye, 2010). Acting as a collective expertise, the ultimate objective of a knowledge environment is to host and support activities of knowledge building aligned with the core strategy. The APL development rooted in a knowledge environment enables agri-FVs to perform more efficiently. Creating a knowledge environment for better APL development is associated with the following three aspects.

(1) Conceptual shift to modern APL

In the past, the primary goal of Chinese agriculture industry is to produce enough food to feed its large population. Today, the goals tend to be high quality, high yield, and high efficiency with safety and ecological considerations. With the changes in farming, conceptual APL should turn to much modern level of consciousness. As one of the most important element constituting the knowledge environment, conceptual shift is of first

importance to spread modern APL knowledge among the people. This is expected to make changes to APL operations through introducing modern APL concept, which encourages APL participants to alter their awareness and behaviours. Modern view of APL differs from the traditional view mainly in three aspects including paradigm shift, management methods, and orientations (see Table 7-6).

Table 7-6 Key differences between traditional and modern views of APL

Key aspects	Traditional view of APL	Modern view of APL
Paradigm shift	Transportation, warehouse	Agri-products supply chain
Management methods	Mainly done by manpower and machinery, lag in information management	Systematic, standardized, automation, intelligent, identification and tracking & tracing of goods movement, information-based networking
Orientations	Individual cost reduction, few considerations for supply chain performance and customer satisfaction	Rapid fulfilment of customers orders, logistics cost reduction, service quality improvement, added value, safety quality, less negative externalities, less loss during transport and storage, considerations of both producers and consumers' interests

(2) Establishing APL standards

“Standards” is simply defined as a set of rules for ensuring a certain level of quality, which is a combination of practices in economic, technological, scientific, and management fields. International Organization for Standardization (ISO) defines “standard” as: *“a standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose”*.

As a foundation for the competence of APL, standards enable better interactions between producers and markets through efficient operations of agri-FVs. The standardization of APL in China needs to be further strengthened to meet the requirements of efficient logistics operations. First of all, there is a lack of standards on category, grading, deviation, packaging of some agri-products, resulting in barriers to efficient storage, process and transport of these products. Second, standard logistics apparatus cannot be widely used by producers and wholesalers. The majority of logistics equipments used by different supermarkets cannot be in common use because of different standards inherently. Third, APL information management and operational specifications are diverse among producers, 3PLs, and retailers.

Due to the importance relating to the efficiency of 3PLs, retailers, and even agricultural development, it is quite necessary to ensure that the supply chain of

agri-products “from farm to table” is participated by several organizations in line with a set of standards. Therefore, as a form of explicit knowledge, APL standards are an essential factor building knowledge for participants and thereby facilitating agri-FV’s functions implementation. A scheme of APL-related standardization consists of five aspects: infrastructure and facilities, information technologies, operations, management, and participants’ behaviour (see Table 7-7).

Table 7-7 A scheme of APL-related standards

Aspects	Detailed items
Infrastructure and facilities	<ul style="list-style-type: none"> - Transport infrastructure - Cold chain logistics facilities
Information technologies	<ul style="list-style-type: none"> - Coding - Data acquisition - Logistics data and structure standard - Logistics information sharing - Quality standard database
Operations	<ul style="list-style-type: none"> - Packaging - Transportation - Storage - Labelling
Management	<ul style="list-style-type: none"> - Basic standard - Safety control - Measurement standard - Statistical standard - Environmental standard - Evaluative criteria - Technical terms standard - Quality certification for 3PLs
Participants’ behaviours	<ul style="list-style-type: none"> - Farmers and co-ops - Processing enterprises - 3PLs - Retailers

(3) Farmers’ education and information networking

Information-based networking becomes a critical part of modern APL and the foundation of sustainability. It depends upon the information-based partnership among farmers, co-ops, 3PLs, agri-FVs, and retailers. However, according to China’s agricultural reality, a large number of farmers are facing limitations in accessing up-to-date information concerning production and market. Education programs provide knowledge in forms of new and advanced techniques in particular the popularization of computer using for farmers and co-ops. As a consequence, they are able to use the Internet for communication, transactions processing, or for information retrieval more broadly. Education programs facilitate information-based logistics operations driven by agri-FVs.

7.5.2.2 Connect knowledge to operating and management

The functional layer of KM connects knowledge to operating and management of agri-FVs. Operations in an agri-FV involve receiving, quality inspection, assortment, storage, processing, sorting dispatch, ordering handing, and may involve container inspection and customs inspection if necessary.

The KM platform (see Figure 7-16) comprises two major parts: information management system and knowledge base. Order processing links agri-FV's supplies (farmers' co-ops) and customers (supermarkets, grocery stores, restaurants, and overseas customers). Accordingly, any agri-FV needs to establish information system at the operational level. Information management system consists of a range of sub systems responding to operations including customs clearance, container yard management, bonded management, transport management, warehouse management, dispatching management, freight forwarding management, ordering management, contract management, quality inspection management, retailers database, farms database.

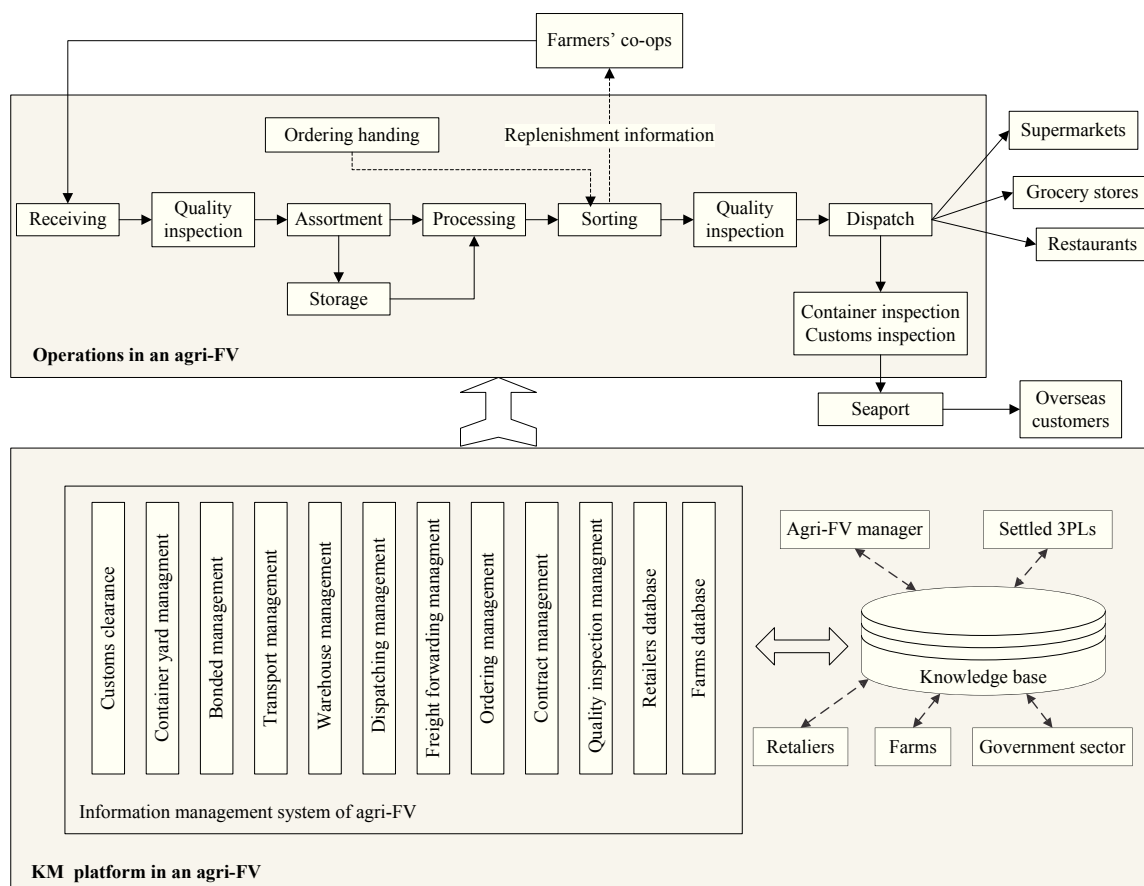


Figure 7-16 KM platform in an agri-FV

The knowledge base pools information and knowledge from APL stakeholders such as agri-FV's managers, located 3PLs, retailers, farms and government sectors. Such stakeholders acquire information and knowledge from the knowledge base. It provides information for the information management system of an agri-FV. Meanwhile, some information processed by the information management system is available for the knowledge base, so as to offer data and facts to their related stakeholders, e.g. food testing report, delivery notice, and the quality of warehouse.

Stakeholders acquire and transfer knowledge via the knowledge base. Agri-FV managers monitor and manage the daily activities, and they offer management regulations, development strategy, and market information to be pooled in the knowledge base.

3PLs acquire information relating to public infrastructure conditions (road, rail and rail conditions, traffic situations), logistics market demands (freight distribution, storage, processing, loading and unloading, etc.), online logistics transaction (logistics EDI, online customs declarations, electronic tax, etc.) and other services (qualification management of registered retailers, APL market survey, APL development, APL-related regulations, laws and even weather broadcast).

Retailers and restaurants seek information about 3PLs such as qualification authentication, core business, reputation evaluation, scale, services scope, and price. It also offers the legal knowledge of contract certificate, legal protection, contract enforcement, quality tracking, liquidated damages, etc. Producers find the information relating to demands and requirements of agri-products. Governmental organizations including authorities, customs, tax administration, commodity inspection acquire information such as freight volume, warehouse capability, logistics facilities and cost, number and the sales of settled 3PLs.

Moreover, in the operations of an agri-FV, knowledge in the form of technology is most contributed and generates benefits for APL development. These logistics-related technologies used in an agri-FV can be:

- Fresh-keeping technologies, e.g. ventilation, drying, cold and chilled storage, modified atmosphere packaging, vacuum refreshing
- Package technologies, e.g. damp proof, vacuum and gas-filled package, aseptic package, and environment-friendly package
- Transport technologies, e.g. bulk transport technology, aseptic transport, cold-chain transport, fresh transport, intermodal transport
- Quality assurance (QA) test technologies, e.g. test technologies of pesticide residues,

veterinary drug, fishery drug, pathogenic bacterium, transgenic food

7.5.2.3 Sustainability check

Broadly speaking, sustainability check focuses on “how are we doing?” and “where do we need to make improvements?” It is a checking tool designed to assess whether sustainability-related business, regulatory, and societal trends have been translated into actual items. Sustainability checking of agri-FV aims to examine the policy, procedure and performance in relation to the sustainability performance of agri-product sector.

The culmination of sustainability check is a CSR or sustainability report which is available to the management, investors, news media, the general public and outside assurance accountants (Coyne, 2006). Sustainability checking report is explicit knowledge definitely providing guidelines for agri-FVs to improve their ways from a sustainable point of view based on the assessment. This process translates practical results into useful knowledge, so as to add experiential knowledge into the knowledge base as well as offer lessons for other agri-FVs to learn.

Sustainability checking report of an agri-FV covers four topic areas: (i) sustainable logistics practices, (ii) community impacts, (iii) relations among suppliers (farmers, farmers’ co-ops), customers (supermarkets, retail stores, and restaurant) and government, and (iv) agri-products quality control.

A guidance of key points for structuring sustainability checking report is provided as following aspects:

(1) Sustainable logistics practices

- Sustainability-oriented organizational learning in agri-FVs: emissions and congestion reduction as well as energy and money saving should be a consideration
- Driver education and training: enable drivers to be aware of fuel-efficient driving, contributing to the safety of both drivers and goods
- Installation of alternative energy sources, e.g. solar photovoltaic, solar hot water, wind, ground source heat pump, and biomass systems; energy/heating saving in offices, buildings, and warehouses; good use of natural lighting, waste disposal and reduction, use of low-emission vehicles, solar roof for energy saving, fuel saving devices using, package recycling, water saving for vehicle cleaning
- Loss reduction in storage and transport and loss prevention for the vehicle fleet, optimizing cycle time of goods collection, intermodal collaboration distribution, information technology & telematics for efficient road freight operations,

performance of cold chains

(2) Community impacts

- GHG emissions and wastewater discharge calculation
- Mitigation of traffic congestion and air pollution, improvements in health and safety to stakeholders
- Involvement in the social sector
- Hidden risks for the communities and human being

(3) Relations among suppliers, customers and government

- The number of contracted farmers' co-ops and collaborated supermarkets, retail stores, restaurants
- Customer and supplier satisfaction survey
- Fulfilment of regional APL services

(4) Agri-products quality control

- Food traceability system establishment and innovations in assessing food quality
- Exemplary practices of free-inspection products supplying
- Quality safety standards, quality inspection system and publicity system

7.6 Summary

This chapter consists of three points. First, it analyses the trends of China's APL development. Through the scanning of current status of APL and city logistics, a number of issues conflicting with the sustainability are identified, such as post-harvest losses during logistics, food safety, contradictions between retail price and farmers' income, air pollution and heavy traffic. In addition, existing APL modes are compared. It identifies future orientations concerning APL development in China, including professional logistics services, short delivery chain, and the coordination of partners.

Second, this chapter explores the applicability of FVs in APL based on experiences learning. The experience covers the integration of logistics functions into public wholesale markets in Japan, urban freight consolidation projects in Kassel and Bremen (Germany), and APL practices in USA and Netherland. Such experience provide implications for the APL develoment in China: reinforcing logistics infrastructure and facilities, special nodes with logistics functions connecting farm householders and consumers, integrated logistics performance, and supportive information services. Accordingly, integrated APL channels with the involvement of agri-FVs are proposed

toward sustainability. Channel I is “farmers’ co-ops + agri-FVs + chain stores”, which highly responds to the FS-docking strategy focusing on the domestic supply of agri-products. Channel II is “farmers’ co-ops + agri-FVs (dry ports) + export”, which increases added values for competing in international markets.

Third, KM approaches are applied to agri-FV project planning and operation. In the planning stage, sense making, knowledge creation, and decision making are included. It proposes several considerations concerning the KM application in agri-FV operation toward APL sustainability. They are creating knowledge environment, connecting knowledge to operating and management, and sustainability check.

CHAPTER 8

Conclusions and future work

8.1 Conclusions

In the face of challenges posed by freight growth, increasing containerization and urban sprawl, the FV concept provides a consolidated logistics solution to improve operational efficiency and minimize externalities. The question “How can FVs support logistics-related activities in meeting the sustainability-oriented objective?” has been explored by this research. The answer to this question is as follows: FVs can enable regional economic growth and eco-friendly transportation as well as improve land use and distribution efficiency. To be more specific, FVs consolidate cargo flows, share joint infrastructure and facilities, reorganize the supply chain, and improve logistics processes in line with the value-added perspective. With regard to the double nature, FVs potentially bring sustainability benefits. FVs are recommended as eco-friendly solutions in supporting green logistics and supply chain management. They contribute to less warehouse dispersion around the country and reduction in vehicle emissions to the central cities. Therefore, sustainable FV concepts are explored to pursue the research question. In this research, agri-FVs are proposed to generate sustainability consequences for APL in China. On the one hand, they can break logistics bottlenecks in implementing FS-docking at present. On the other hand, they help to promote the export of hinterland agri-products by providing convenient services as seaports function.

Knowledge is viewed as a vital resource tightly associated with competences. KM is becoming a guiding business philosophy which influences strategies undertaken by managers of an organization. It enables managers and operators to systematically organize planning work and actively perform toward the organizational objectives. This research states that KM can be an important factor for accelerating an organization toward sustainability based on the analysis of SBSC. SBSC exposes such relationships between knowledge/KM and sustainability: (i) knowledge (information, skills, experts) is the fundamental resource and leverage for sustainability performance, (ii) KM activities (learning) enable the optimization of organizational operations, (iii) preconditions of stakeholders benefits satisfaction: stakeholders identification, knowing of their needs and contributions, and (iv) assessment and monitor for sustainability performance are

essential for further KM.

Major features of the logistics sector in China today are identified: growing logistics market, insufficient logistics efficiency, rising logistics outsourcing, etc. Considering such features, a PEST analysis indicates that FVs are quite necessary in China due to the fulfilments of several prerequisites: government involvements, economic growth, investments in traffic infrastructure especially on railway construction, and increasing attention to technological development. It highlights six categories of causes for the barriers to FV development in China: initial prerequisites, strategic positioning, operational capability, regional synergy, management structure, and green logistics. In addition, the possible strategies for further development of FVs in the context of China's logistics situation are proposed: make use of double nature; attach more importance to the planning stage of FV projects; considering KM approaches in planning and operating a FV; explore the applicability of FVs in more areas considering the social needs.

A well-prepared planning process plays a key role in avoiding negative phenomena in actual operations, e.g. unnecessary FV projects, high vacancy rates, improper location selection, and over-sizing. Such mismanagement will not only waste resources, but also affect other organizations' social and economic activities. A good FV plan depends largely on the well-managed knowledge, which is usually processed with feasibility analysis, strategic making, multiple consultations, policy recommendations, and information management. To cope with the complexity and uncertainty of problems crossing three dimensions of economy, environment, and society, it is important to take into account different types and sources of knowledge. The planning stage of a FV project depends on the identification, interpretation, creation and use of involved knowledge. KM provides a planned, structured approach of systematically and actively managing knowledge for achieving the expected objectives.

This research provides implications for the developers at the planning stage. Firstly, when initiating a FV project, the developers are suggested to consider multi-sided influences (logistics/traffic, economy, ecological environment, society). Focusing on single aspect will easily lead to unsustainable trajectories. Especially, developers should be aware of the original motivations for FV projects and the adaption conditions. It must be pointed out that the pure "copy" of readymade cases and mismanagement constructions are discouraged. Secondly, FV project planning takes time as well as needs experiences and technical knowledge, thus the planner team of high quality (well-educated, experienced, professional, and dedicated) becomes a key factor. Thirdly,

the “sense-making KM model” is used as a guide to help planners to inadequately identify the definition and situations. Based on the SECI model, planners are able to acquire and generate both explicit and tacit knowledge for a specific plan. Decision making makes for a specific plan based on a set of sustainability-oriented evaluation.

KM has received considerable attention as it is crucial to ensure sustainable competitive advantages in the marketplace. The emerging field of KM is identified by this research as a potential source of valuable insights with which to obtain sustainability performance of FVs. Considering the “integration” and “collaboration” in logistics and supply chain management, two characteristics of KM in the context of FVs are distinguished from general industrial clusters: multi-levels of knowledge mapping and collaborative KM. The logistics strategy development and sustainability performance are enabled by retrieving and analyzing useful intangible resources/knowledge assets and integrated solutions in a timely and cost-effective manner. KM activities can create awareness of sustainability; clarify the responsibility and accountability in FV development; strengthen the commitment and cooperation of 3PLs via knowledge sharing; learn more advanced logistics technologies. In addition, the SBSC evolved from BSC convinces that the knowledge-related perspective is the foundation and guarantee for sustainable FVs.

In this research, the KM process cycle (knowledge acquisition, knowledge sharing, and knowledge utilization) facilitates the synergy effects involving: synergy of firms within a FV, synergy of FVs and ecological environment, synergy of FVs and regional development. Specifically, the actions of KM for a sustainable FV include are included in such aspects: identify the logistics market demand and customer preferences; recognize the value of new knowledge for lifting logistics efficiency; track related policies and regulations on transportation; balance the competition and cooperation of enterprises engaged in the same field in a FV; promote positive interactions with other FVs and local authorizes; advocate green packaging and warehousing, low-emission vehicles, eco-friendly intermodality, and alternative fuels, etc. This research proposes a roadmap of organizing these KM actions to build sustainability capability for a FV. The roadmap is structured by three layers: social foundation layer, functioning layer, and auditing layer. The three layers interact with others by knowledge expansion, knowledge processes, and knowledge gap discovery. To support the success of this roadmap, three key elements are identified including human ability, stakeholder engagement, and information system. Finally, a checklist for building sustainability capacities for FVs is generated following

the route of SBSC. Hopefully, it can be helpful to convert knowledge resource into sustainability performance by FV operators and decision makers.

APL in China is facing post-harvest losses during logistics, as well as contradictions between retail prices and farmers' actual profits. In addition, logistics-related urban problems (e.g. air pollution, traffic congestion) are drawing much attention. Considering the existing APL modes, future orientations are proposed to cope with such problems and challenges: provide professional logistics services concerning the qualified services, cost control, and food safety; change the situation of "too many middlemen"; keep the information flow transparent throughout the supply chain, and coordinate the involved participants.

The Japan APL experience implicates that the logistics node is much useful rather than middlemen in APL. City logistics implementation in Kassel and Bremen point out that using freight terminals connected to near central cities with combined transport can reduce freight cost per unit and CO₂ emission. The following three considerations based on such experiences may offer implications for the APL development in China: logistics infrastructure and facilities are most important for efficient APL; special nodes with logistics functionality are necessary; integrated logistics performance is required; adequate information services assist to add value throughout the whole supply chain of agri-products.

An integrated APL system is designed consisting of farmers' co-ops, chain stores, and agri-FVs. Among these transformations, agri-FVs play an important role in leveraging an integrated APL system toward sustainability. An interacting mechanism is created to support this system and two channels are involved. The channel of "farmers' co-ops + agri-FVs + chain stores" is an appropriate solution to the "FS-docking" program implementation in China, since it can break the bottlenecks from the logistics perspective. In this channel, agri-FVs can be in the form of service-extended general FVs, transformation of suitable wholesale markets, and specialized FVs purely serving in APL. Another channel of "farmers' co-ops + agri-FVs (dry ports) + export" is helpful to increase values of agri-products with the export accessibility offered by dry ports.

By using KM approaches to agri-FV projects' planning and operation, the general processes can be applicable: (i) in planning: sense making, knowledge creation, and decision making; (ii) in operating: building a knowledge environment, connecting knowledge to operating and management, and sustainability check.

8.2 Future work

The research work introduced in this dissertation can be extended in multiple directions:

- (1) Paradigm shift in developing and evaluating FV projects considering quantitative approaches, in particular, the establishment an evaluation index system for the sustainability performance assessment of FVs;
- (2) FV-network for the optimization of logistics flows from a relative overall perspective and adapted implementation strategies;
- (3) Adopt other suitable management solutions for sustainable FV development;
- (4) Find out FVs' potential contributions to other industries;
- (5) The dissertation focuses more on China's logistics sector, FV development, city logistics issues, and special APL current situations. It may not be fully applied in other countries due to their different backgrounds. Therefore, extending the research of sustainable FVs to other countries or contexts is necessary to be considered into future work.

REFERENCES

- Accenture. (2006). *Creating an effective China cold supply chain*.
- AccountAbility. (2008). AA1000 standards account ability principles standard. from <http://www.accountability.org/images/content/0/7/074/AA1000APS%202008.pdf>
- Agronet. (2013). How to achieve agricultural & super docking? . from <http://zt.agronet.com.cn/ncdj/index.html>
- Aguilar, F. J. (1967). *Scanning the business environment*. New York: Macmillan.
- Alwis, R. S.-d., & Hartmann, E. (2008). The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises. *Journal of Knowledge Management*, 12(1), 133-147.
- Aramyan, L., Ondersteijn, C., Kooten, O. V., & Lansink, A. O. (2006). Performance indicators in agricultural products production chains *Quantifying the agricultural products supply chain* (pp. 49-66). Netherlands Springer.
- Argote, L., & Ingram, P. (2000). Knowledge transfer: a basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169.
- Armistead, C. (1999). Knowledge management and process performance. *Journal of Knowledge Management Practice*, 3(2), 143-157.
- Arslan, O., & Er, I. D. (2008). SWOT analysis for safer carriage of bulk liquid chemicals in tankers. *Journal of Hazardous Materials*, 154(1-3), 901-913.
- Arvis, J.-F., Mustra, M. A., Ojala, L., Shepherd, B., & Saslavsky, D. (2012). *The logistics performance index and its indicators*. Washington, DC.
- Ayuso, S., Rodríguez, M. Á., & Ricart, J. E. (2006). Using stakeholder dialogue as a source for new ideas: a dynamic capability underlying sustainable innovation. *Corporate Governance*, 6(4), 475 - 490.
- Banerjee, A., & Solomon, B. D. (2003). Eco-labelling for energy efficiency and sustainability: a meta-evaluation of US programs. *Energy Policy*(31), 109-123.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.
- Bentzen, K., Hoffmann, T., & Bentzen, L. (2003). *Best practice handbook for logistics centers in the Baltic Sea region*, NeLoc.: Denmark: FDT-Association of Danish Transport Centres.
- Beresford, A., Pettit, S., Xu, Q., & Williams, S. (2012). A study of dry port development in China. *Maritime Economics & Logistics*, 14, 73-98.
- Bernaer, S., De Causmaecker, P., Vanden Berghe, G., & Vermeulen, T. (2006). *Agent models to control complexity in multi modal transport*. Paper presented at the ECUMICT-European Conference on the Use of Modern Information and Communication Technologies.
- BMVBS. (2008). *Freight transport and logistics masterplan*: Federal Ministry of Transport, Building and Urban Affairs.
- BMVBS. (2010). *Freight transport and logistics action plan - logistics initiative for Germany*: Federal Ministry of Transport, Building and Urban Development.
- Boile, M., Theofanis, S., & Strauss-Wieder, A. (2008). *Feasibility of freight villages in the NYMTC*
- Boisot, M. H. (1998). *Knowledge assets: securing competitive advantage in the information economy*. USA: Oxford University Press.

- Boulton, E. G. (2008). Sustainable directions: the freight village concept. *Australasian Freight Logistics*(12), 36-39.
- Bramlett, J. (2012). Logistics in-sourcing: the new trend. from <http://www.smartfreightware.com/2012/08/logistics-in-sourcing-the-new-trend/>
- Cadilhon, J.-J., Fearne, A. P., Hughes, D. R., & Moustier, P. (2002). Wholesale markets and food distribution in Europe: new strategies for old functions. from <http://nhjy.hzau.edu.cn/kech/ncpyxx/study/pdf/4.pdf>
- Cerreño, A. L. C. d., Shin, H.-S., Strauss-Wieder, A., & Theofanis, S. (2008). *Feasibility of freight villages in the NYMTC region: Task 1 - Inventory of planning resources*. Piscataway.
- Chiang, L., & Edward, N. (2012). Analysis: middlemen take toll on China agricultural profits. from <http://www.reuters.com/article/2012/02/02/us-china-economy-agriculture-idUSTRE8110A320120202>
- Choo, C. (1998). *The knowing organization: how organizations use information for construct meaning, create knowledge and make decisions*. New York: Oxford Press.
- CIVITAS, & VIVALDI. (2006). Improving city logistics. from http://www.civitas-initiative.org/index.php?id=79&sel_menu=134&measure_id=72
- Clarkson, M. B. E. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. *Academy Management Review*, 20(1), 92-117.
- Cobia, D. (Ed.). (1989). *Cooperatives in Agriculture*, . Englewood Cliffs, NJ Prentice-Hall.
- Colin, S., Henriette, L., & Paul, T. (2011). *Guide to supply chain management*: Springer Berlin Heidelberg.
- Commission, E., & Transport, D.-G. f. E. a. (2001). *White paper-European transport policy for 2010: time to decide*.
- Conner, K. R., & Prahalad, C. K. (1996). A resource-based theory of the firm: knowledge versus opportunism. *Organization Science*, 7(5), 477-501.
- Coyne, K. L. (2006). Sustainability auditing. *Environmental Quality Management*, 16(2), 25-41.
- Creech, H., & Willard, T. (2001). *Strategic intentions: managing knowledge networks for sustainable development*: International Institute for Sustainable Development.
- CSL. (2006). *China logistics parks survey report*: China Society of Logistics (CSL).
- CSL. (2008). *China logistics parks survey report*: China Society of Logistics (CSL).
- CSL. (2012). *China logistics parks survey report*: China Society of Logistics (CSL).
- Daghfous, A. (2003). How to make knowledge management A Firm's core capability. *Journal of Knowledge Management Practice*.
- Dalkir, K. (2005). *Knowledge management in theory and practice* (1st ed.). Amsterdam, Boston: Butterworth-Heinemann.
- Danese, P., Romano, P., & Formentini, M. (2013). The impact of supply chain integration on responsiveness: the moderating effect of using an international supplier network. *Transportation Research Part E: Logistics and Transportation Review*, 49(1), 125-140.
- Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, 3(3), 210 - 222.
- Davenport, T. H., & Prusak, L. (1998). *Working knowledge: how organizations manage what they know*. Boston: Harvard Business School Press.

- Davidsson, P., Henesey, L., Ramstedt, L., Törnquist, J., & Wernstedt, F. (2005). An analysis of agent-based approaches to transport logistics. *Transportation Research Part C*, 13, 255-271.
- Dewitt, W., & Clinger, J. (2007). *AIB05: Committee on Intermodal Freight Transport*. Chairman: Gerhardt Muller, U.S. Merchant Marine Academy Intermodal Freight Transportation.
- DGG. (2009). The key characteristics of Freight Villages (GVZ). from http://www.gvz-org.de/index.php?id=47&no_cache=1&L=1
- DGG. (2010). Ranking of European Freight Haulage Centers 2010. from <http://www.businesslocationcenter.de/en/B/v/popupseite0.html>
- DHL. (2010). *Delivering tomorrow: towards sustainable logistics how business innovation and green demand drive a carbon-efficient industry*. Bonn.
- Dias-Sardinha, I., Reijnders, L., & Antunes, P. (2002). From environmental performance evaluation to eco-efficiency and sustainability balanced scorecards. *Environmental Quality Management*, 52-64.
- Doherty, S., & Hoyle, S. (2009). *Supply chain decarbonization*: World Economic Forum.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: concepts, evidence, and implications. *Academy Management Review*, 20(1), 65-91.
- Dong, Q. (2012). *Logistics integration field: theory and practice for international inland port*. Beijing: Social sciences academic press.
- Driscoll, C., & Starik, M. (2004). The primordial stakeholder: advancing the conceptual consideration of stakeholder status for the natural environment. *Journal of Business Ethics*, 49(1), 55-73.
- Drucker, & Ferdinand, P. (1989). The new realities: in government and politics *Economics and business in society and world view*. New York: Harper & Row.
- ECMT. (1993). *Terminology on combined transport(English-French-German-Russian)*: ECMT-European Conference of Ministers of Transport.
- Elbert, R., Haasis, H.-D., Schönberger, R., & Landwehr, T. (2009). *Adapting dynamic logistics processes and networks: advantages through regional logistics clusters*. Paper presented at the second international conference of dynamics in logistics, Bremen.
- ESCAP. (2005). *Review of developments in transport in Asia and the Pacific*. New York: Economic and Social Commission for Asia and the Pacific.
- ESCAP. (2010). *Introduction to the development of dry ports in Asia*. Paper presented at the Regional expert group meeting on the development of dry ports along the Asian highway and trans-Asian railway networks, Bangkok.
- ESCAP, & KMI. (2008). *Logistics sector developments: planning models for enterprises and logistics clusters*: Transport and Tourism Division of ESCAP, the Korea Maritime Institute (KMI).
- Esper, T. L., Fugate, B. S., & Davis-Sramek, B. (2007). Logistics learning capability: sustaining the competitive advantage gained through logistics leverage. *Journal of Business Logistics*, 28(2), 57-81.
- Etzkowitz, H. (1997). The entrepreneurial university and the emergence of democratic corporatism. In H. Etzkowitz & L. Leydesdorff (Eds.), *Universities and the global knowledge economy: a triple helix of university-industry-government relations* (pp. 141-152). London: Cassell.
- Europlatforms. (2000). *FV-2000: quality of freight villages structure and operations*: European Commission Directorate General for Energy and Transport.
- Europlatforms. (2004). *Logistics centres directions for use*: Europlatforms EEIG.

- Evans, N., & Easterby-Smith, M. (2001). Three types of organizational knowledge: implications for the tacit-explicit and knowledge creation debates. from <http://www2.warwick.ac.uk/fac/soc/wbs/conf/olkc/archive/olk4/papers/evans.pdf>
- Fang, D. (2005). Planning method of German freight village. *China Logistics & Purchasing*, 16, 60-63.
- Figge, F., Hahn, T., Schaltegger, S., & Wagner, M. (2002). The sustainability balanced scorecard - linking sustainability management to business strategy. *Business Strategy and the Environment*, 11(5), 269-284.
- Fineman, S., & Clarke, K. (1996). Green stakeholders: industry interpretations and response. *Journal of Management Studies*, 33(6), 715-730.
- Forsyth, T. (2007). Promoting the "development dividend" of climate technology transfer: can cross-sector partnerships help? *World development*, 35(10), 1684-1698.
- Frazzon, E. M., & Scholz-Reiter, B. (2009). *Converting knowledge into performance within global production and logistic systems*. Paper presented at the Second International Conference, Bremen, Germany.
- Freeman, R. E. (1984). *Strategic management: a stakeholder approach*. Englewood Cliffs (NJ): Prentice-Hall.
- Gao, S., & Zhang, J. (2001). A comparative study of stakeholder engagement approaches in social auditing. In J. Andriof & M. McIntosh (Eds.), *Perspectives on corporate citizenship* (pp. 239-255). Sheffield: Greenleaf Publishing.
- Gminder, C. U., & Bieker, T. (2002). *Managing corporate social responsibility by using the "sustainability-balanced scorecard"*. Paper presented at the 10th international conference of the greening of industry network, Göteborg, Sweden.
- Grabara, J., Bajdor, P., & Okwiet, B. (2010). Center as a tool for logistics activities in support of the company on the example of SME's enterprise X. *Activities Polish Journal of Management Studies*, 2(1), 35-42.
- Gudehus, T., & Kotzab, H. (2009). *Comprehensive logistics*. Heidelberg: Springer-Verlag Berlin.
- Haasis, H.-D. (2008). Knowledge management in intermodal logistics networks. In H.-J. Kreowski, B. Scholz-Reiter & H.-D. Haasis (Eds.), *Dynamics in Logistics* (pp. 269-275): Springer Berlin Heidelberg.
- Haasis, H.-D., Wildebrand, H., Plöger, M., & Zimmermann, F. (2009). *AMATRAK-traffic avoidance through intelligent control of freight service on the basis of autonomous multi-agent transport Coordination*. Paper presented at the XIII Euro working group on transportation.
- Han, X. (2011). Higeen turnover doubles Buji market. from <http://www.sz2011.org/Universiade/news/shenzhen/30515.shtml>
- Hawks, K. (2006). What is reverse logistics? , from <http://www.rlmagazine.com/edition01p12.php>
- He, L. (Ed.). (2009). *China logistics parks*. Beijing: China Logistics Publishing House.
- Henriques, I., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal*, 42(1), 87-99.
- Higgins, C. D., & Ferguson, M. R. (2011). *An Exploration of the Freight Village Concept and its Applicability to Ontario*. Toronto.
- hktdc. (2013). 22 New projects launched under "Go West" strategy. Retrieved 28 Mar, 2013, from <http://economists-pick-research.hktdc.com/business-news/article/Business-Alert-China/22-New-projects-launched-under-%2593Go-West%2594-strategy/bacn/en/1/1X000000/1X09QZAT.htm>

- Hodges, R. J., Buzby, C., & B. Bennett. (2011). Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *Journal of Agricultural Science*, 149, 37-45.
- Holdings, S. i. (2012). *Seven-eleven Japan's business model*.
- Holsapple, C. W., & Whinston, A. B. (1996). *Decision support systems - a knowledge-based approach*. Saint Paul, MN: West Group.
- Holtgen, D. (1995). *Terminals, intermodal logistics centres and european infrastructure policy*. University of Cambridge, UK.
- Hu, D. (2010). *Farmer-supermarket direct purchase: a how-to guide*. Beijing: China Agricultural Science Publishing.
- Hu, D., Reardon, T. A., Rozelle, S., Timmer, P., & Wang, H. (2004). The emergence of supermarkets with Chinese characteristics: challenges and opportunities for China's agricultural development. *Development Policy Review*, 22(5), 557-586.
- Huber, G. (1991). Organizational learning: the contributing processes and the literature. *Organization Science*, 2(2), 88-115.
- IPCC. (2007). *IPCC fourth assessment report of the intergovernmental panel on climate change*. Cambridge.
- ISL. (2007). *Promotion strategies for intermodal transport solution*. Bremen: Institute of Shipping Economics and Logistics.
- ISL. (2010). *The concept and practice of freight village*. Bremen: Institute of Shipping Economics and Logistics.
- IUCN, UNEP, & WWF. (1980). *World conservation strategy*. IUCN: Gland, Switzerland-WWF: Gland, Switzerland-UNEP: Nairobi, Kenya: International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environmental Programme (UNEP), World Wide Fund for Nature (WWF).
- Jansen, H. (2011). Flushing port may in the meantime also be called banana harbour. from http://www.freshplaza.com/news_detail.asp?id=76457
- Jeffery, N. (2009). *Stakeholder engagement: a road map to meaningful engagement*: Doughty Centre, Cranfield School of Management.
- Jiang, Z. (2009). Farming-supermarket docking is a good way to agriculture. *Qiushi*(23), 38-40.
- Jordan, A., Bahre, E., Gollnik, J., Hage, R., & Heiland, M. (2006). *Freight villages in Brandenburg and Berlin-traffic and logistical starting point of the railway connection to the Baltic States, potentials and requirements*. Potsdam: Company for the Development of Infrastructure and Related Projects Ltd.
- Köhler, U. (1999). *City logistics in Kassel*. Paper presented at the 1st international conference on city logistics, Cairns, Australia.
- Köhler, U. (2003). *New ideas for the city-logistics-project in Kassel*. Paper presented at the 3rd international conference on city logistics, Maderia, Portugal.
- Kakabadse, N. K., Kouzmin, A., & Kakabadse, A. (2001). From tacit knowledge to knowledge management: leveraging invisible assets *Knowledge and Process Management*, 8(3), 137-154.
- Kaplan, R. S., & Norton, D. P. (2001). *The strategy-focused organization: how balanced scorecard companies thrive in the new business environment*. Boston: Harvard Business Press.
- Kapros, S., & Joignaux, G. (1996). Les territoires de la logistique: le cas du Nord-Pas de Calais. *Revue d'Economie Régionale et Urbaine*(1).
- Kapros, S., Panou, K., & Tsamboulas, D. A. (2005). Multicriteria approach to the evaluation of intermodal freight villages. *Transportation Research Record: Journal of the Transportation Research Board*, 1906, 56-63.

- Kariye, B. W. (2010). *The political sociology of security, politics, economics & diplomacy*: AuthorHouse.
- Kearney, A. T. (2010). *China 2015: Transportation and Logistics Strategies. Leadership requires innovation, expansion and redesigned networks*.
- Kerckhoffs, E., & Vangheluwe, L. (1996). *A multi-agent architecture for sharing knowledge and experimental data about waste Water treatment plants through the internet*. Paper presented at the EUROMEDIA 96, society for computer simulation international.
- Khalozadeh, Kazemi, F., Abbas, S., Movahedi, M., & Jandaghi, G. (2011). Reengineering university-industry interactions: knowledge-based technology transfer model. *European Journal of Economics, Finance & Administrative Sciences*(40), 47-58.
- King, W. R. (Ed.). (2009). *Knowledge management and organizational learning*: Springer.
- Kirsch, D. (2008). Knowledge asset. from http://it.toolbox.com/wiki/index.php/Knowledge_Asset
- Knieriem, S., & Nobel, T. (2011). *25 Jahre Güterverkehrszentrum Bremen Vom Pilotprojekt zur Erfolgsgeschichte*. Berlin: Wissenschaftlicher Verlag
- KPMG. (2008). Logistics in China. from http://www.kpmg.com.cn/en/virtual_library/Property_Infrastructure/LogisticsChina.pdf
- Kyriazopoulos, E., & Artavani, M.-A. (2006). *The role of freight villages to the development of the Balkan region. The case of Promachon freight village (Greek Bulgarian borders)*. Paper presented at the European Regional Science Association, Volos, Greece.
- Lammgård, C. (2007). *Environmental perspectives on marketing of freight transports - the intermodal road- rail case*. Göteborg University, BAS Förlag, Göteborg.
- Lee, E., & Song, D. (2010). Knowledge management for maritime logistics value: discussing conceptual issues. *Maritime Policy & Management*, 37(6), 563-583.
- Lefebvre, S. (2003). Dynamic output compensation between selected channels in power systems autonomous *Systems and intelligent agents in power system control and operation* (pp. 155-178). Berlin: Springer-Verlag.
- Lerner, L. D., & Fryxell, G. E. (1994). CEO stakeholder attitudes and corporate social activity in the Fortune 500. *Business and Society*, 33(1), 58-81.
- Lev, B. (2001). *Intangibles: management, measurement, and reporting*. Washington, D.C.: Brookings Institution Press.
- Lewis, H., Gertsakis, J., Grant, T., Morelli, N., & Sweatman, A. (2001). *Design and environment: a global guide to designing greener goods*. Sheffield: Greenleaf Pubns.
- Lin, L. (2010). *Study on performance of integrate with agricultural base & supermarket based on DEA*. Beijing Jiaotong University, Beijing.
- Liu, P., Raahemi, B., & Benyoucef, M. (2011). Knowledge sharing in dynamic virtual enterprises: a socio-technological perspective. *Knowledge-Based Systems*, 24(3), 427-443.
- Liu, Y. (2008). Competitive advantage analysis of SMEs clusters. *Technological Development of Enterpris*, 27(3).
- Lorne, F. T., & Dilling, P. (2012). Creating values for sustainability: stakeholders engagement, incentive alignment, and value currency. from <http://www.hindawi.com/journals/econ/2012/142910/>

- Lundvall, B.-A., & Rodrigues, M. J. (Eds.). (2002). *The new knowledge economy in Europe: a strategy for international competitiveness and social cohesion*. Cheltenham: Edward Elgar Pub.
- Ma, F. (2010). Discussion on the impact of "alliance of agriculture and Supermarket" on supermarket and its counter measures. *Journal of Anhui Agri Sci*, 38(9), 4959-4960.
- Macharis, C., & Bontekoning, Y. M. (2004). Opportunities for OR in intermodal freight transport research: a review. *European Journal of Operational Research*, 153(2), 400-416.
- Mainali, B., Ngo, H. H., Guo, W., Pham, T. T. N., & Johnston, A. (2011). Feasibility assessment of recycled water use for washing machines in Australia through SWOT analysis. *Resources, Conservation and Recycling*, 56(1), 87-91.
- Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *Computing Surveys*, 26(1), 87-119.
- Maqsood, T., Finegan, A. D., & Walker, D. H. T. (2003). *Extending knowledge management across the supply chains in the construction industry: knowledge sharing in construction supply chains*. Paper presented at the second international conference on construction in the 21st century (CITC-II).
- Mariani, M. (2007). *Sustainable agricultural products supply chains and systems*: Preparatory Document of the WT35.
- Massa, S., & Testa, S. (2009). A knowledge management approach to organizational competitive advantage: evidence from the food sector. *European Management Journal* 27(2), 129-141.
- Matos, S., & Silvestre, B. S. (2012). Managing stakeholder relations when developing sustainable business models: the case of the Brazilian energy sector *Journal of Cleaner Production*, xxx, 1-13.
- Mendes, P., Santos, A. C., Perna, F., & Teixeira, M. R. (2012). The balanced scorecard as an integrated model applied to the Portuguese public service: a case study in the waste sector. *Journal of Cleaner Production* 24(6), 20-29.
- Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853-886.
- Mittendorf, H. J., & J.D.Tracey-White. (1992). *Managing wholesale markets*: FAO Corporate Document Repository.
- Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(7), 20-38.
- Morsink, K., PeterS.Hofman, & JonC.Lovett. (2011). Multi-stakeholder partnerships for transfer of environmentally sound technologies. *Energy Policy* 39(1), 1-5.
- Muller, G. (1999). *Intermodal freight transportation*: Eno Transportation Foundation, Inc.
- Nathanail, E. (2007). Developing an integrated logistics terminal network in the CADSES. . *Transition Studies Review*, 14(1), 125-146.
- NDRC, & Nankai-Logistics (Eds.). (2011). *Report of China logistics development*. Beijing: China Logistics Publishing House.
- Negayama, K., & Weill, P. (2004). *Seven Eleven Japan: reinventing the retail business model*: Massachusetts Institute of Technology.
- Nestle, S. (2012). Freight Villages (GVZ) in Germany as key factor for intermodal transport. from <http://www.eupag.eu/ceestall/powerpoint/CEESTAL2-Nestler.pdf>
- Nestler, S. (2012). *Management and operating of Freight Village - the example Germany* Paper presented at the Green Logistics Park and Freight Village - 3rd meeting of TFG.

- Neto, J. A. (2010). Co-operation for the sustainable development in industrial clusters: A Brazilian case study. from http://sistemas-producao.net/redecoop/images/pdf/prodsust/euroma_2010_marcos_barros_e_amato_neto.pdf
- Neumann, G., & Tomé, E. (2005). *Knowledge management and logistics: an empirical evaluation*. Paper presented at the 5th international conference on knowledge management, Graz, Austria.
- Nobel, T., Diekmann, C., & Koch, H. (2012). *City logistics experience and perspectives*. Bremen: Institute of Shipping Economics and Logistics.
- Nobel, T., Nestler, S., Münch, S., & Koch, H. (2010). *Ranking der europäischen GVZ-Standorte: Benchmarking der europäischen Erfahrungen*. Berlin: wvb Wissenschaftlicher Verlag.
- Nonaka, I., & Konno, N. (1998). The concept of "ba": building a foundation for knowledge creation. *California Management Review*, 40(3), 40-54.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: how Japanese companies create the dynamics of innovation*. USA: Oxford University Press.
- Nonaka, I., & Toyama, R. (2003). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. *Knowledge Management Research & Practice*, 1, 2-10.
- Nonaka, I., Toyama, R., & Byosiére, P. (2001). A theory of organizational knowledge creation: understanding the dynamic process of creating knowledge. In M. Dierkes, A. B. Antal, J. Child & I. Nonaka (Eds.), *Handbook of organizational learning & knowledge*: Oxford University Press.
- Nonaka, I., Toyama, R., & Nagata, A. (2000). A firm as a knowledge-creating entity: a new perspective on the theory of the firm. *Industrial and Corporate Change*, 9(1), 1-20.
- Norman, P. M. (2002). Protecting knowledge in strategic alliances: resource and relational characteristics. *The Journal of High Technology Management Research*, 13(2), 177-202.
- NZTE. (2012). *Food and beverage in China market profile* New Zealand Trade and Enterprise.
- OECD. (2003). *Delivering the goods, 21st century challenges to urban goods transport*. Paris.
- Otsuka, K. (2006). *Development of industrial clusters: east Asia experience and new development strategy for Africa*. Paper presented at the The labor markets team in the social protection network in conjunction with PREM and DEC
- Perrini, F., & Tencati, A. (2006). Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems. *Business Strategy and the Environment*, 15(5), 296-308.
- Polanyi, M. (1964). *Personal knowledge - towards a post critical philosophy*: University Of Chicago Press.
- Polonsky, M. J. (1995). A stakeholder theory approach to designing environmental marketing strategy. *Journal of Business & Industrial Marketing*, 10(3), 29-46.
- Porter, M. E. (1979). How competitive forces shape strategy. *Harvard Business Review*, March/April 1979.
- Porter, M. E. (1990). *The competitive advantage of nations: with a new introduction*. London: Palgrave Macmillan.
- Powell, W. W., & Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology*, 30, 199-220.

- Prusack, L. (2001). Where did knowledge management come from? *IBM Systems Journal*, 40(4), 1002-1007.
- Rügge, I., & Scholz-Reiter, B. (2011). *Internationalization of the doctoral training program for the German degree "Dr.-Ing."*. Paper presented at the 5th international conference of software, knowledge information, industrial management and applications.
- Ramokgopa, L. N. (2004). *City logistics: changing how we supply*. Paper presented at the Southern African Transport Conference.
- Rawson, R., & Hooper, P. D. (2012). The importance of stakeholder participation to sustainable airport master planning in the UK. *Environmental Development*, 2, 36-47.
- Raymond, C. M., Fazey, I., Reed, M. S., Stringer, L. C., Robinson, G. M., & Evely, A. C. (2010). Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management*, 91(8), 1766-1777.
- Reardon, T., & Berdegue, J. A. (2002). The rapid rise of supermarkets in Latin America: challenges and opportunities for development. *Policy Review*, 20(4), 371-388.
- Rimiené, K., & Grundey, D. (2007). Logistics centre concept through evolution and definition. *Engineering economics*, 54(3), 87-95.
- Roemer, J. (2011). Multimodal transport operators. *Background paper on multimodal transport*, from <http://www.sla.org.sg/mto>
- Rondinelli, D., & Berry, M. (2000). Multimodal transportation, logistics, and the environment managing interactions in a global economy. *European Management Journal*, 18(4), 398-410.
- Roso, V., Woxenius, J., & Lumsden, K. (2009). The dry port concept: connecting container seaports with the hinterland. *Journal of Transport Geography*, 17(5), 338-345.
- Rotheroe, N., Keenlyside, K., & Coates, L. (2003). Local agenda 21: articulating the meaning of sustainable development at the level of the individual enterprise. *Journal of Cleaner Production*, 11(5), 537-548.
- Ruben, R., Slingerland, M., & Nijhoff, H. (2006). *Agro-food chains and networks for development issues, approaches and strategies*
- S.DeNisi, A., A.Hitt, M., & Jackson, S. E. (2003). The knowledge-based approach to sustainable competitive advantage. In S. E. Jackson, A. DeNisi & M. A. Hitt (Eds.), *Managing knowledge for sustained competitive advantage: designing strategies for effective human resource* (pp. 4). San Francisco: Jossey-Bass.
- Sachs, S., & Maurer, M. (2009). Toward dynamic corporate stakeholder responsibility: from corporate social responsibility toward a comprehensive and dynamic view of corporate stakeholder responsibility. *Journal of Business Ethics*, 85(3), 535-544.
- Sbihi, A., & Eglese, R. W. (2010). Combinatorial optimization and green logistics. *Annals of Operations Research*, 175(1), 159-175.
- Schaefer, A., & Harvey, B. (2000). Environmental knowledge and the adoption of readymade environmental management solutions. *Eco-Management and Auditing*, 7(2), 74-81.
- Schank, B. R. C., & Abelson, R. P. (1977). *Scripts, plans, goals, and understanding: an inquiry into human knowledge structures*. Hillsdale, N.J: Lawrence Erlbaum Associates.
- SDT. (2008). *Best practices: freight mobility, managing freight effectively from the city and shipper perspective*: Seattle Department of Transportation.

- Segev, E. (2010). Mapping knowledge into a database model organizational routines, processes, practices, and norms. *Journal of Knowledge Management Practice*, 11(1).
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699-1710.
- Simon, H. A. (1977). *The new science of management decision*. Englewood Cliffs, NJ: Prentice Hall College Div.
- Sirikijpanichkul, A., & Ferreira, L. (2005). *Multi-objective evaluation of intermodal freight terminal location decisions*. Paper presented at the 27th conference of Australian institute of transport research (CAITR), Queensland.
- Smith, J., Adhikari, A., & H.Tondkar, R. (2005). Exploring differences in social disclosures internationally: a stakeholder perspective. *Journal of Accounting and Public Policy*, 24(2), 123-151.
- SMR. (2008). *SMR International White Paper: Knowledge asset management in the current economic crisis*.
- SpA, I. B. (2005). *Social report* Bologna: Interporto Bologna SpA
- Stähle, P. (2003). *Lecture in a post graduate school of knowledge management and intellectual capital*. Unpublished manuscript, Tampere.
- Stanley, M. (2012). The China files: the logistics journey is just beginning
- Steurer, R., Langer, M. E., Konrad, A., & Martinuzzi, A. (2005). Corporations, stakeholders and sustainable development I: a theoretical exploration of business-society relations. *Journal of Business Ethics*, 61(3), 263-281.
- Strange, T., & Bayley, A. (2008). *Sustainable development: linking economy, society, environment*: OECD Publishing.
- Strauss-Wieder, A. (2008). *Freight villages and integrated logistics centers in the US - opportunities for freight operations to create economic value and be good neighbors*.
- Sullivan, a., & Sheffrin, S. M. (2003). *Economics: principles in action*. Upper Saddle River, New Jersey: Pearson Prentice Hall.
- Suresh, R. (2001). Knowledge management: an overview. from http://www.providersedge.com/docs/km_articles/km_an_overview.pdf
- Tan, K.-C., Kannan, V. R., Handfield, R. B., & Ghosh, S. (1999). Supply chain management: an empirical study of its impact on performance. *International Journal of Operations and Production Management*, 19(10), 1034-1052.
- Taniguchi, E. (2012). The future of city logistics. from <http://www.delivering-tomorrow.com/the-future-of-city-logistics/>
- Tao, J. (2009). *Layout planning and operations of freight villages*. Beijing: China Logistics Publishing House.
- Teece, D. J. (1998). Capturing value from knowledge assets: the new economy, markets for know-how and intangible assets. *California Management Review*, 40(3), 55-79.
- Tencati, A., & Zsolnai, L. (2009). The collaborative enterprise. *Journal of Business Ethics*, 85(3), 367-376.
- Tenuto, J. (2007). Corporate sustainability: a new business model for the 21st century. Retrieved 28, 03, 2013, from http://www.tenutophotography.com/themes_sustain.htm
- Teo, C. P., & Goh, J. O. (2001). Impact on inventory costs with consolidation of distribution centers. *IIE Transactions*, 33(2), 99-110.

- Thabrew, L., Wiek, A., & Ries, R. (2009). Environmental decision making in multi-stakeholder contexts: applicability of life cycle thinking in development planning and implementation. *Journal of Cleaner Production*, 17(1), 67-76.
- Tiwana, A. (2002). *The knowledge management toolkit: orchestrating IT, strategy and knowledge platform* (2nd ed.): Prentice Hall.
- Tong, J. (2011). Managing logistics higher education using logical framework analysis. *International Journal of Innovation, Management and Technology*, 2(4), 309-314.
- Tongpang, J., & Praneetpolgrang, P. (2011). *An application of tabu search algorithms and genetic algorithms in collaborative distribution center logistics optimization*. Paper presented at the SRII global conference (SRII).
- Tracey-White, J. D. (1991). *Wholesale markets: planning and design manual*. Rome: Food and Agriculture Organization of the United Nations.
- Tsamboulas, D., Kapros, S., & Ballis, A. (1997). *The creation of the Greek network of freight Villages: expected impact on regional development*. Paper presented at the international conference on "Urban, regional, environmental planning and informatics to planning in an era of transition", Athens.
- Tsamboulas, D. A., & Kapros, S. (2003). Freight village evaluation under uncertainty with public and private financing. *Transport Policy*, 10(2), 141-156.
- Tu, S. (2010). Investigation on the strategy of the development of low-carbon logistics in China in low-carbon economy from
<http://www.seiofbluemountain.com/upload/product/201010/2010dthy02a7.pdf>
- UNCTAD. (1991). *Handbook on the management and operation of dry ports*. Geneva: UN.
- UNECE. (2001). *Terminology on combined transport*. New York and Geneva: Economic Commission for Europe (UN), European Conference of Ministers of Transport and European Commission.
- UNESCAP. (2007). *Review of developments in transport in Asia and the Pacific 2007*. New York: United Nations Economic and Social Commission for Asia and the Pacific.
- UNESCAP. (2009). *Review of developments in transport in Asia and the Pacific 2009*. New York: United Nations Economic and Social Commission for Asia and the Pacific.
- VanElst, L., Choi, I., & Song, M. (2007). An Integration Architecture for Knowledge Management Systems and Business Process Management Systems. *Computers in Industry*, 58, 21-24.
- Veenstra, A., Zuidwijk, R., & Asperen, E. v. (2012). The extended gate concept for container terminals: expanding the notion of dry ports. *Maritime Economics & Logistics*, 14, 14-32.
- Vermeulen, W. J. V., & Seuring, S. (2009). Sustainability through the market - the impacts of sustainable supply chain management: introduction. *Sustainable Development*, 17(5), 269-273.
- Via-Bremen. (2012). GVZ Bremen is a European front-runner. from
http://www.via-bremen.com/64_2
- Visser, J., van Binsbergen, A., & Nemoto, T. (1999). *Urban freight transport policy and planning*. Paper presented at the 1st international symposium on city logistics.
- Vleugel, J. (2004). Modelling goods city distribution in the Netherlands. *European Transport*, 28, 20-33.
- von Krogh, G. (1998). Care in knowledge creation. *California Management Review*, 40(3), 133-153.

- Vrenken, H., Macharis, C., & Wolters, P. (Eds.). (2005). *Intermodal transport in Europe*. Brussels: European Intermodal Association EIA.
- Waddock, S. (2001). Integrity and mindfulness: foundations of corporate citizenship. In J. Andriof & M. McIntosh (Eds.), *Perspectives on corporate citizenship* (pp. 25-38). Sheffield: Greenleaf Publishing.
- Wadhwa, S., & Madaan, J. (2007). Conceptual framework for knowledge management in reverse enterprise system. *Journal of Knowledge Management Practice*, 8(2), 1-22.
- Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, Canada: Sage Publications.
- Weisbrod, R., Swiger, E., Muller, G., Rugg, M., & Murphy, M. K. (2002). *Global freight villages: a solution to the urban freight dilemma*. Paper presented at the TRB annual meeting, Washington, D.C.
- Welford, R. (1995). *Environmental strategy and sustainable development: the corporate challenge for the twenty-first century*. New York: Routledge Press.
- Wernerfelt, B. (1984). A resource-based view of the firm issue. *Strategic Management Journal*, 5(2), 171-180.
- Wiig, K. M. (1997). Knowledge management: an introduction and perspective. *The Journal of Knowledge Management*, 1(1), 6-14.
- Wikipedia. (2012). Home delivery. from http://en.wikipedia.org/wiki/Home_Delivery
- Wikipedia. (2013a). Seven-Eleven. from <http://en.wikipedia.org/wiki/7-Eleven>
- Wikipedia. (2013b). Stakeholder engagement. from http://en.wikipedia.org/wiki/Stakeholder_engagement
- Wikipedia. (2013c). Waste management. from http://en.wikipedia.org/wiki/Waste_management
- Winger, R., & Wall, G. (2006). *Food product innovation: a background paper*. Rome: Food and agriculture organization of the united nations.
- wiseGEEK. (2012). What is a middle man? , from <http://www.wisegeek.com/what-is-a-middle-man.htm>
- wisegeek. (2013). What is a Specialty Store? , from <http://www.wisegeek.com/what-is-a-specialty-store.htm>
- Wisetjindawat, W. (2010). *Review of good practices in urban freight transportation: UNESCAP*.
- Wong, K. Y., & Aspinwallb, E. (2006). Development of a knowledge management initiative and system: a case study. *Expert Systems with Applications*, 30(4), 633-641.
- Wooldridge, M. J., & Jennings, N. R. (1995). Agent theories, architectures, and languages: a survey. In M. J. Wooldridge & N. R. Jennings (Eds.), *Intelligent agents: ECAI-94 workshop on agent theories, architectures, and languages* (pp. 1-39). Berlin: Springer-Verlag.
- Yang, C.-C., Marlow, P. B., & Lu, C.-S. (2009). Knowledge management enablers in liner shipping. *Transportation research Part E*, 45(6), 893-903.
- Ye, S., & Tiong, R. (2000). NPV-Risk Method in Infrastructure Project Investment Evaluation. *Journal of Construction Engineering and Management*, 3, 227-233.
- Yima, N.-H., Kima, S.-H., Kimb, H.-W., & Kwahk, K.-Y. (2004). Knowledge based decision making on higher level strategic concerns: system dynamics approach. *Expert Systems with Applications*, 27, 143-158.
- Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review*, 40(4), 45-58.

- Zhang, C., Tang, D., Liu, Y., & You, J. (2008). *A multi-agent architecture for knowledge management system*. Paper presented at the fifth international conference on fuzzy systems and knowledge discovery, Jinan, China.
- Zhang, S., & Li, S. (2010). Morden retail approache to morden agricultural development *Journal of Nanjing University of Science and Technology*, 23(4), 10-14.
- Zingales, F., & Hockerts, K. (2003). *Balanced scorecard & sustainability: examples form literature and practice*: CMER.